THE

# ELECTRICAL REVIEW.

VOL. LXXVI. FEBRUARY 5, 1915. No. 1,941.

## ELECTRICAL REVIEW.

Vol. LXXVI.] CONTENTS: February 5, 1915. [No. 1,941.

| | Page |
|---|---|
| Electricity Supply ... | 165 |
| Copper ... | 166 |
| Electric Nitrogen Furnaces ... | 166 |
| Alien Enemies and Legal Rights ... | 167 |
| German Trade in 1913 ... | 167 |
| Modern Wiring Work, Particularly in Bad Situations, by H. C. Tofield ... | 168 |
| Correspondence— | |
| 200 Telephone Electricians Wanted ... | 169 |
| Jowers Protective Leakage Device ... | 169 |
| A.C. *v.* D.C. for Lighting ... | 169 |
| The Capture of German Foreign Trade ... | 170 |
| Salaries of Junior Engineers ... | 171 |
| Wonderful Accumulator Cells ... | 172 |
| New Electrical Devices, Fittings and Plant (*illus.*) ... | 172 |
| Legal ... | 174 |
| Our Legal Query Column ... | 175 |
| War Items ... | 175 |
| Foreign and Colonial Tariffs on Electrical Goods ... | 177 |
| Business Notes ... | 177 |
| The E.T.U.: London District ... | 183 |
| Notes ... | 184 |
| City Notes ... | 187 |
| Stocks and Shares ... | 189 |
| Market Quotations ... | 190 |
| Metal Market—Fluctuations in January ... | 191 |
| A New Nitrogen Electric Furnace (*illus.*) ... | 191 |
| The Telephone in Surgery ... | 194 |
| The Shape of the Pressure Wave in Electrical Machinery, by S. P. Smith, R. S. H. Boulding, and S. P. Smith (*illus.*) | 195 |
| Electric Heating and Cooking ... | 197 |
| Breakdowns in Colliery Electrical Plant, by L. Foster ... | 198 |
| Trading and Industrial Methods in Germany ... | 199 |
| New Patents Applied For, 1915 ... | 200 |
| Abstracts of Published Specifications ... | 200 |
| Contractors' Column ... | Advertisement page xviii |

THE ELECTRICAL REVIEW.

**Published every FRIDAY, Price 4d.**

*The Oldest Weekly Electrical Paper. Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

***OFFICE :—4, LUDGATE HILL, LONDON, E.C.***

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933: Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

**Subscription Rates.**—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

**FOREIGN AGENTS:**

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

**THE UNIVERSAL ELECTRICAL DIRECTORY**

**(J. A. Berly's).**

**1915 EDITION**

**IN THE PRESS.**

***H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.***

## ELECTRICITY SUPPLY.

ON Wednesday evening last week, at a meeting of the Students of the Institution of Electrical Engineers, Mr. Charles H. Merz delivered an extremely interesting lecture on the subject of electricity supply on the large scale in populous areas, illustrating his remarks with lantern views and diagrams. By virtue of the positions he occupies and the unique experience that he has acquired, the lecturer is exceptionally well equipped for dealing with a subject which we may regard as his speciality, and it is to be regretted that the reproduction of his lecture *in extenso* is not permissible.

In the first place, Mr. Merz established by logical processes the fact that the interconnection of several large adjoining areas for the purpose of supplying electricity was essential to reliability combined with economy; each area can receive a supply from at least two directions, and instead of having a separate stand-by plant in each generating station, the whole of the stations become mutual guarantors of the continuity of supply. Plant of the same total rating then gives a greater degree of reliability than would otherwise be attained, and, roughly, we may say that with $n$ stations working together, the individual generating sets may be $n$ times as large. This, of course, results in a great reduction in capital cost, as well as in steam consumption. Generating sets of 25,000 KW. capacity have already been put to work, with excellent results, and Mr. Merz, who is accustomed to thinking in large units, sees nothing to prevent the installation of 50,000-KW. sets at no distant date.

Another result of interconnection is improved load factor, and the lecturer, showing maps of the North-East Coast network, by far the largest example of the kind in this country, gave startling figures for the load factor attained in that area. It must be admitted that the region in question, with its enormous industrial demand for electric power, possesses exceptional advantages from this point of view. The remarkable development of the so-called "waste-heat" station system was well illustrated by statistics and diagrams; but here again the district is quite exceptional in character. It is worthy of note that a company, free from the trammels that embarrass municipal undertakings, was able to carry out this huge system, which would have been impossible in the case of a municipality.

Amongst possible openings for the further development of electricity supply, and the improvement of the power factor, the lecturer referred especially to electric traction on railways, which has already made considerable progress on Tyneside, and he pointed out that there is a tendency to advocate electrification for suburban service only, on account of the advantages of electricity where there are frequent stops; but the economy of electric traction does not depend on the stops, but on the density of the traffic, and Mr. Merz emphasised the fact that a material saving can be effected on a railway of any length whatever, without regard to stops, if the traffic is heavy and continuous. The mineral traffic on some branches of the North-Eastern Railway fulfils the conditions, and the new electric service with overhead high-pressure supply to the locomotives, which will soon be inaugurated by the company on one of these lines, is expected to prove highly economical.

Some doubt, he said, had been cast upon the effect of diversity of demand upon the load factor of a large power station, but he met this not only by reference to the results achieved on the North-East Coast, but also by a telling satire upon the conditions at present obtaining in the London area. When practically all requirements are filled by electrical means, it will obviously be impossible for all

the demands to occur simultaneously. If the present "system" were perpetuated, a suburban resident would have his breakfast cooked by electricity from one power station, and would travel to town in a train propelled by a second; his office would be lighted and heated by a third, and, as likely as not, his lunch would be cooked by a fourth, while his tramway journeys during the day would be energised by a fifth. In the evening possibly he would travel to the West-End with power from a sixth station, attend a theatre supplied from a seventh, and sup at a restaurant connected with an eighth. This absurd partition of the load would be avoided if all the supply were derived from one homogeneous interconnected system, and the benefits of the diversity factor would then be fully realised.

There can be no doubt as to the disadvantages of the present methods; the difficulty lies in finding a satisfactory way of co-ordinating the numerous systems, and the County Council finds that it has tackled a very thorny problem.

We understand that Mr. Merz looks forward to the development of electricity supply in London to something like 15 times its present volume; Sir John Snell guardedly hinted at 10 times, and we are inclined to think that Mr. Merz's estimate is somewhat biased on the high side by his experience on Tyneside, the industrial demands of which are much heavier than those met with in the London area. But there is certainly scope for enormous developments in connection with the domestic uses of electricity and electric traction, and we hope that eventually Mr. Merz's figure will be justified by realisation.

---

**Copper.**

The strength of the copper market has been unabated within the past few weeks, and it is by no means certain that the advance, important though it has been already, has yet spent itself. The excellence of the trade demand is admitted on all sides, the major portion of the buying coming from the brass section, which is unprecedentedly busy on ammunition orders, mainly for home needs, but also in part for the Allies.

An enormous consumption of copper is proceeding in connection with the provision of munitions of war, and there is not the smallest chance of all our efforts being abated to furnish the huge armies in the field with ample supplies wherewith to drive back the baby-killers and thieves who are endeavouring to lay waste the whole of Europe. Producers have fully recognised the strength of the position arising from the big demands which are encountered, and have raised their prices by steady and successive stages, until now they are in the neighbourhood of £68 10s. a ton for electrolytic. Very large business has been booked within the last three weeks or so, and the demand is still in evidence. Not only has the call for copper from Europe been important, but there has been a revival in United States home trade buying, and under the joint influence of the domestic and export demands, the stocks of refined metal in first hands across the Atlantic have been drawn upon to such an extent as to threaten a moderate degree of scarcity.

It had been suspected for some little time that a part of the buying of standard copper in the open market came from America, and this has now received confirmation. It is known that leading American producers have bought largely of warrants, and are contemplating the shipment of several thousand tons of rough copper from British warehouses to their refineries on the Atlantic seaboard of the United States. The assertion is made that it is only by securing material available here, that it will be possible for them to fulfil their engagements, for the supply of copper suitable for the refineries to run upon has been pretty well exhausted across the Atlantic. It remains to be seen whether the position has not been overdrawn in this respect, but meantime there is at least an even chance of the bulk of the rough copper at present available for the use of British refiners being shipped to North America for conversion into electro copper, which material will in the fulness of time be shipped over to us. The position is not liked, however, and the British Government have for the time put a stop to the shipment, though it is possible that the embargo may be removed in a few days.

There are vague reports that output is to be increased in America, and if the position in respect of rough copper is as described, it is indeed high time that mine and smelter production there was increased. It is sheer nonsense for the pro-German element in the United States to howl about British naval activity in stopping exports to Germany, and to allege that we incidentally are half paralysing business in the Montana mining camps, when the said mining camps are not permitted to produce sufficient copper to supply present needs. However, logic forms no part of the stock-in-trade of the pro-German.

The European visible supply on January 31st was 35,125 tons, against 36,308 tons on January 15th, and 35,432 tons on December 31st. A year ago the total was 25,944 tons. The supplies coming forward during last month totalled 35,502 tons, made up as follows:—North America 22,520 tons, Spain and Portugal 2,132 tons, and other countries 4,233 tons, the shipments from Chile being 4,617 tons, and those from Australia 2,000 tons. The deliveries were 35,809 tons.

---

**Electric Nitrogen Furnaces.**

The paper describing his three-phase electric furnace for the direct fixation of atmospheric nitrogen, which Mr. E. Kilburn Scott recently read before the Society of Chemical Industry, brings once again into prominence the problem how best to establish in this country an industry of such national importance as the manufacture of nitric acid. The derived salts of nitric acid, such as nitrate of lime or sodium and ammonium nitrates, are not only of value as fertilisers, but with the acid itself they form the foundation of the manufacture of explosives, and that we, as a nation, should be content to rely on oversea supplies for so vital an element of national defence is a state of affairs that calls at least for earnest consideration.

It has already been established by the successful operation of the Birkeland-Eyde, Schönherr-Hessberger and Pauling furnaces in Norway and elsewhere, that the direct method of fixing nitrogen by "burning" it in the electric arc can compete on the one hand with the old Chile saltpetre method, and, on the other hand, with the more indirect method of obtaining it from the air by means of calcium carbide and calcium cyanamide or the Ostwald contact process, although the possibilities of the latter method have by no means been gauged as yet to the full. Great Britain to be sure cannot develop water power either to the extent or for the price at which it can be obtained in Norway, but against this has to be set the saving in freights involved in shipping the liquid acid to this country, or in sending the ammonia liquor over to Norway, there to be converted into ammonia nitrate and shipped back again here in that form. The present yield of the nitrogen furnaces in practical operation is stated to be equivalent to some 60 to 70 grams of pure nitric acid per KW.-hour. If the results which Mr. Kilburn Scott's new furnace has given in the experimental stage are reached on an industrial scale, his yield should attain the high figure of 90 to 100 grams of acid per KW.-hour, an advantage which, even if it stood alone, would weigh heavily in the scale against the superiority which Norway's natural gifts afford her. The fact that the increased yield is very largely the result of employing the hotter flame of a three-phase instead of a single-phase arc furnace, the inherent simplicity of the new furnace, and its smooth working on the small scale, are strong reasons why the increased yield should no less be realised in practice than in the laboratory.

The whole question, apart altogether from the merits of one particular process, has a broader aspect from the point of view of the conservation of power. The utilisation of the idle hours of central power stations for the running of auxiliary power-consuming chemical processes is constantly being urged by progressive engineers. The situation created by the war affords an opportunity for progress in this direction, which should be at once seized, both by the power producers and the power consumers. The manufacture of

nitrates is only one among quite a considerable number of electrochemical and electrometallurgical processes which can be developed as well in this country as they have been on the Continent, if one can only bring about the necessary co-ordination between the different interests concerned. The discussion of this matter is one which our great engineering societies are in a pre-eminent position to initiate and to guide.

---

**Alien Enemies and Legal Rights.**

Ever since the commencement of the present war commercial men and their legal advisers have been in a state of considerable doubt as to their rights and liabilities in dealing with alien enemies. Some difficulties were resolved by special Acts of Parliament and certain Royal Proclamations; but it was reserved to the Judges to declare the rights of an alien enemy as a suitor in English Courts of Law. As a result of certain cases recently argued before the full Court of Appeal, the following principles have now been authoritatively laid down:—

1. The term "alien enemy," when used in reference to civil rights, does not mean a subject of enemy nationality, the test not being nationality, but the place of business; in other words, not nationality, but domicile.
2. An alien enemy has no right to sue in the King's Courts during the war except by special licence or authorisation of the Crown.
3. An alien enemy can be sued in the King's Courts during the war, and, if so sued, may appear and defend, and, if defeated, may appeal.
4. A plaintiff, being an alien enemy, against whom judgment has been pronounced before the war, cannot present or prosecute an appeal during the continuance of the war.

There are some points about these principles of law which are likely to surprise the non-legal reader. In the first place, it seems that a man of German birth, whether a registered alien or not, is not an alien enemy, and can enjoy all the rights of a British subject, if he happens to be living in England. On the other hand, a loyal British subject who happens to be interned in Germany or Austria at this moment, must be regarded as an alien enemy. If he were in a position to communicate with his solicitor in London he could not issue a writ. On the contrary, a German merchant in London who could still sing with heart and voice:—

Ich habe mich ergeben, mit Hertz und mit Hand,
Dir Land voll Lieb und Leben, dir Deutsches Vaterland!

may still sue and recover money in the King's Courts.

It is possible that many of our readers, at the outbreak of the war, had money owing to them by German firms. If those firms can be sued it were well to bring suit at once; but there are two difficulties:—

1. The difficulty of effecting service of proceedings.
2. The difficulty of recovering anything if the suit is successful.

However, if there are any assets in this country and a manager who is in control of them, something may be gained by the institution of proceedings.

---

**German Trade in 1913.**

Although only issued at the beginning of January, the report on the trade of Germany in 1913 by Sir Francis Oppenheimer, British commercial attaché in Berlin—to which we briefly referred a fortnight ago, and of which we give an ample abstract on another page to-day—contains a mass of information which is worthy of careful study by British firms who are engaged on the promotion of the export trade in general. The report mentions, in the first place, that there is hardly a branch of manufacture or trade which has not its own organisation and journal, and thus the conditions of the home market are said to be fully disclosed, whilst news from abroad is published and carried into distant workshops. As in previous reports, so in the present one, is the question of syndicates discussed at length. The well-known fact is pointed out that the huge works which have each concentrated under one roof, particularly in the coal mining and iron and steel trades, various stages of manufacture have little interest in the various syndicates controlling the respective stages of manufacture unless they are granted preponderating figures of allotments. On the other hand, the smaller works naturally prefer a state of syndication which guarantees their existence, checks competition, secures steady prices in the home market, and provides export bounties for the foreign orders. The huge undertakings have become world concerns; they embrace so many branches of manufacture and command so many markets as to reach above local industrial tides. The rise of the gigantic works, although it has been greatly assisted by modern developments of the banking system, is chiefly attributed to the application of science to manufacturing by carrying the science of the utilisation of by-products to its utmost limits, and therefore reducing the cost of production. The huge concerns, of which every industry boasts increasing numbers, exercise a steadying influence on the country's economic life, because their interests are world interests. At the same time the desire for high figures of allotments in the syndicates appears to act as a fatal temptation to the expenditure of vast sums upon extensions which no one expects to see permanently utilised. The result is an enormous augmentation in the productive capacity, and actual over-production shortens the period of a boom and leads to a forced export trade. Indeed, the export trade, which alone is capable of feeding the extended works, may even grow, while the strength has gone out of the boom, notwithstanding a record export trade, as in 1913.

The report, proceeding to state that the desire to save expensive labour has naturally led to an increased use of machinery, records a very interesting point. It is that the Germans, instead of being so willing, as in the past, to agree to customers' special requirements, are having a scramble for orders for standard patterns, it having become difficult to find makers who will accept stray orders for goods which differ from the ordinary patterns. Coming to consider the question of export markets, the report recalls, more particularly from the second half of 1913, the fact that the necessity for a larger German export seemed uppermost in the public mind, and that two scientific institutions were formed early in 1914 to teach the science of international trading. The export trade receives practical official support, export railway rates have been reduced, and cable rates for week-end messages were also lowered to a number of countries early in 1914, whilst foreign loans are made subject to the grant of commercial concessions. In addition, the export trade is supported by the shipping companies, a uniform bill of lading was agreed upon at the close of 1913, and manufacturers, merchants, and shippers have combined to form special foreign trading societies, which now exist individually for Greece, Turkey, Argentina, Brazil, South America generally, Russia, France, the Balkans, Austria, Hungary, Italy, and Roumania. These societies, which have the moral support of the highest official circles in Germany, formed themselves into a union early in 1914, so as to benefit mutually from each other's experience, and they intend to centralise their labours in regard to statistical and other material to be collected in view of negotiations for the new treaties of commerce. Finally, the foreign trade is facilitated by the existence of 17 foreign banks which have branches in different parts of the world.

The foreign trade in machinery and electrical manufactures is briefly referred to towards the end of the report. The value of the imports and exports, accepting one mark as the equivalent of a shilling, is recorded as follows:—

| | Imports. | | Exports. | |
|---|---|---|---|---|
| | 1912. | 1913. | 1912. | 1913. |
| Machinery ... | £3,850,000 | £4,050,000 | £31,515,000 | £33,915,000 |
| Electro-technical products ... | 520,000 | 650,000 | 11,985,000 | 14,525,000 |

It appears that out of the total exports of machinery in 1913 a quantity of 19 per cent. of the weight was forwarded to Russia, 11 per cent. to Austria-Hungary, 10 per cent. to France, 7 per cent. to the United Kingdom, and 5 per cent. each to Belgium, Holland and Italy. In conclusion, the report mentions that the export trade in electrical products to Austria-Hungary, Russia, France, Italy and Switzerland is being rendered increasingly difficult owing to the rise of local industries which are being developed under the local system of protection.

D

## MODERN WIRING WORK, PARTICULARLY IN BAD SITUATIONS.

By H. C. TOFIELD.

Systems of wiring for electric light and power installations are of interest to many, and with some fifteen years' experience in designing and supervising the erection of installations of all kinds and under nearly every condition of service, the writer may claim some knowledge of this important subject.

At one time it was considered that a good class installation of screwed, galvanized conduit would satisfy the requirements of almost any position. It was, so to speak, the last word in wiring practice and was expected to protect the wires under all circumstances.

From the point of view of mechanical protection it was generally a success, but from other considerations frequently a failure.

Since the advent of what are known as cab-tire sheathed (C.T.S.) wires and cables, which are now made by several eminent cable manufacturers (although it seems only fair to state that they were originally designed for this purpose by the St. Helens Cable and Rubber Co.), wiring methods in what may be termed "difficult situations" have undergone a radical change.

Notwithstanding, however, the remarkable advantages afforded by this C.T.S. system of wiring, comparatively little seems to be known about it either in regard to published descriptions of work done, or by many of the consulting engineers and contractors. These people still specify and use the older systems of wiring for work that could be dealt with much more effectively and cheaply by the C.T.S. type.

So the writer, having used this class of cable for a number of installations, principally in and around the Black Country, where, it will be admitted, conditions are exceptionally severe, and having installed it in chemical works and similar places where it has afforded the most gratifying results, considers it will be to the public interest to publish some notes upon this class of cable, and hopes they will not be taken for a mere write-up of a comparatively new article.

A short description of the methods of wiring and the types of accessories used with the C.T.S. system should be of interest to all those who are called upon, from time to time, to provide an electrical installation which will be proof against the effects of moisture and corrosion.

The principal defects of the ordinary systems of wiring, when installed in unsuitable positions, may be briefly summarised:—

*Wood casing.*—Casing should only be used in conjunction with vulcanised rubber-covered wires under ideal conditions and where the premises to be wired are perfectly dry. It is prohibited under the I.E.E. rules for damp situations.

*Screwed conduit.*—Screwed conduit when installed with proper inspection fittings and galvanised where run in wet situations, affords a sound protection to the V.I.R. wires against mechanical damage and dampness. It will not last for any length of time in chemical works or where other certain manufacturing processes are being carried on. It is also susceptible to condensation, which is another objection to its use in many situations. Water condensed inside the conduit, due to changes of temperature, and rust, rot the insulation on the wires and it then becomes simply a matter of time as to when leakages will take place, the period being governed by the quality of the wires installed and the amount of moisture present.

*Lead-covered wires.*—If V.I.R. and lead-covered wires are used in wet situations where traces of acid are present, the lead covering is quickly attacked and destroyed. It is particularly affected by electrolysis, and careful earthing of the sheathing must be carried out in order to prolong its life in this respect. Oil impregnated paper and lead-covered wires, as sometimes manufactured for house wiring, have been used in dry situations with success, but if the lead sheathing is injured they become useless. Under certain conditions the lead covering gradually crumbles away, especially where ammonia is present. Lead is likewise seriously affected when secured to damp brickwork and buried in new plaster. When lead-covered wires are used, very careful handling and skilled labour in erecting and jointing are necessary.

*Cased wires.*—V.I.R. wires cased in either tinned copper or soft metal suffer from most of the defects of lead covered wires, moreover they require a number of special accessories and wiremen experienced in the particular system to erect same. They are very subject to mechanical damage and where run in plaster require suitable protection. In chemical works and all similar situations they are useless.

*General.*—The above remarks only lightly touch upon the defects of the various systems enumerated, but they are sufficient to indicate that when any of them is used under adverse conditions, trouble with the installation will be experienced sooner or later.

The introduction of a system which would be suitable for all situations has, until lately, been considered an object almost impossible of attainment, and this will not occasion surprise when it is borne in mind that such a system must also be capable of satisfactorily meeting the requirements of any type of installation met with in practice.

The private house, public building, factory, and works each call for special treatment and as in many cases nowadays severe atmospheric conditions have to be contended with, it is a matter of no small difficulty to provide a method of wiring which will be equally effective under all circumstances.

In many situations, more especially in certain manufacturing works, the conditions are so varied that the achievement of one object defeats another.

Assuming all technical difficulties to be overcome, it is a great advantage to be able to employ a method of carrying out the work which will substantially resemble the means adopted when erecting casing, conduit or lead-covered wires, so that any competent wireman, without previous experience in the new system, can install it in a satisfactory manner and within a reasonable time.

Extensive deviations from the systems with which the workman is acquainted saddle the contractor with the expenses occasioned by his permanent staff having to acquire the necessary experience of the new method, and when pressure of work demands the employment of additional labour, he is at a still greater disadvantage.

The C.T.S. wiring system presents no difficulty in this respect, for it is practically identical with V.I.R. and lead covered wiring, so far as the simplicity of installing it is concerned, while it has the additional advantage that the wires may be very roughly handled and bent in any shape required without impairing their insulating and other qualities.

Wherever used, in the writer's experience, it has proved most successful, not only where it was adopted for house wiring and ordinary workshop installations, but where used in positions in which nearly every other system had been tried in the past and had failed.

The details of C.T.S. wiring may be briefly enumerated as follows:—

*When used in wet and corrosive situations.*—1. For working under the most severe conditions it may be depended upon to meet every possible requirement and, in the writer's opinion, will outlast any other system of wiring.

2. The fittings required in connection with this class of wiring are a novel form of corrosion-proof

junction-box (used for the purposes of jointing or looping the wires when necessary), a special type of corrosion-proof switch, and a lamp holder. These accessories must not be confused with the usual type of so-called acid-proof fittings, as the C.T.S. type *will* fully protect the ends of the wires against all outside corrosive influences. Ordinary good quality watertight ironclad distribution boards and main-switches can be used and the cases of these should be drilled as required to take ebonite glands. With the addition of a simple form of ebonite cleat, the system may be said to be complete and no further special accessories of any kind are required.

3. The wiring of an installation can be carried out by any competent wireman without previous experience of the C.T.S. system, and in less time than most other systems require.

*When used under ordinary conditions.*—1. For private house, workshop and factory wiring in dry situations, it provides a first class installation *without the use of any special accessories*, but a novel type of patented ebonite junction-box can be obtained in order to save looping the wires down to switches, &c. The wires may be run either concealed in floors, down partitions and behind wainscotting or, if desired, on the surface. They can be safely buried in plaster or laid direct in the ground, and they are equally impervious to moisture, acids, or chemical fumes, while vermin appear to ignore them.

2. *All ordinary switches, ceiling roses, distribution boards and other accessories can be used.*

3. The saving effected in running the wires, owing to there being neither casing nor tubing to erect nor special fittings to assemble, is at once apparent.

From the above remarks it will be clear that a system of wiring is provided which will satisfactorily cope with almost any condition that can arise in practice.

*Comparison of Costs.*—The cost of installing C.T.S. wires complete with ordinary accessories will compare favourably with any other good class wiring system, and the labour costs are specially low where C.T.S. wires are used for wiring buildings in course of construction and existing buildings where all work is required to be concealed, and therefore cutting away is entailed.

The following table is intended to give an idea of the approximate cost per point controlled by one switch for wiring carried out with various systems under average conditions. Pendants, lamps and shades are not included.

| | Cost per point. s. | d. |
|---|---|---|
| 1. Heavy gauge screwed conduit ... ... ... ... | 21 | 0 |
| 2. Brazed light gauge slip conduit with continuity fittings ... ... ... ... ... ... ... ... ... | 14 | 6 |
| 3. Close joint ditto ... ... ... ... ... ... ... ... | 10 | 6 |
| 4. Lead-covered V.I.R. wiring in damp situations | 13 | 0 |
| 5. Ditto in dry positions ... ... ... ... ... ... ... | 10 | 6 |
| 6. Stannos wiring used as concentric earthed return system ... ... ... ... ... ... ... ... | 12 | 6 |
| 7. Ditto run as two separate conductors with copper sheathing as protection ... ... ... ... | 22 | 0 |
| 8. Casing and V.I.R. wires ... ... ... ... ... ... | 12 | 0 |
| 9. C.T.S. wires run in dry situations with ordinary accessories ... ... ... ... ... ... ... ... | 13 | 6 |
| 10. V.I.R. wires run on porcelain cleats ... ... ... | 9 | 6 |
| 11. Twin V.I.R. and cotton-covered flex on button insulators ... ... ... ... ... ... ... ... ... | 8 | 6 |

The above figures can only be approximate, and they will vary very considerably according to the kind of fixings available.

The ease and rapidity with which C.T.S. wires can be run under floors and inside partitions, also on brick walls which are to be plastered, are exclusive features of this system and a revelation to those who have used lead covered and similar systems requiring a multitude of fitments. And, as labour is the chief factor in estimating for work, since there is usually very little difficulty in computing the material required, this important point will appeal favourably to prospective users.

***(To be continued.)***

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### 200 Telephone Electricians Wanted.

Your courtesy in putting my letter in your issue of January 1st, when I asked for some telephones for the Royal Artillery, has been rewarded, and I have been able to get in touch with several people who are providing the necessary instruments. May I ask you to help further, and insert an advertisement for men in the following form?

"200 telephone electricians wanted by the Royal Field Artillery for enlistment. Age 19-38; for three years or the duration of the war, or six years with the Colours and eight with the Reserve. Capable of repairing telephones and lines under fire. Will be taught Morse code and to ride. Army rates of pay at present prevailing. Must be able to pass usual medical examination.

"Apply in writing, stating age, height, qualifications and experience, to the Secretary of the National Service League, 72, Victoria Street, S.W., who will provide railway pass warrants for suitable men. Envelopes must be marked :—'Telephonists.'"

**R. MacLeod,**
*Secretary, National Service League.*

72, Victoria Street, London, S.W.
*February 1st*, 1915.

### Jowers Protective Leakage Device.

Mr. Ernest F. Butler's letter in your issue of the 22nd inst. contains one or two mis-statements which we should like to correct.

We would beg to point out that this device is so arranged that on the occurrence of a leakage current the starter is automatically brought to the "off" position and mechanically locked in that position until the starter cover has been taken off and the mechanical interlock removed. Once this has occurred, therefore, it is not possible for the "heedless operator" to make persistent efforts to start up the motor with a fault on it, as the starter arm is locked mechanically. It is not necessary, therefore, to bring the starter to the first contact; in fact, it is impossible to do so.

The maximum current which can be broken on the first stop of the starter is, of course, limited by the starter resistance, and we cannot see how any arc which would burn the operator could take place. The point to remember is that the starter arm is locked off mechanically.

It is not claimed that the device is a perfect one to deal with every possible condition. Practical experience, however, shows that it deals with a very persistent cause of trouble, as follows :—

A fault develops on the motor which causes the overload release on the starter arm to operate. The user immediately starts the motor up again, and keeps on doing this until more serious trouble results. With this device, however, he is prevented from doing this, as the arm is mechanically locked off. His instructions then are to pull the main switch out and report the matter to the works, and a proper electrician looks into the matter and remedies the fault.

The device is intended for those cases where motors are installed on premises where a competent electrician is not always available, and it is believed that starters fitted with this device will have a great advantage over the practice hitherto followed.

**The General Electric Co., Ltd.**
A. RAILING, *Director.*

Birmingham, *January 27th*, 1915.

### A.C. v. D.C. for Lighting.

I have read with considerable interest and much wonder the series of statements made in Mr. Fowler's letter of the 23rd inst., published in your issue of to-day's date.

It would be a great relief to all classes of electrical workers if Mr. Fowler could explain fully his second paragraph. It seems to me that the question of the number of live wires is independent of the type of supply—unless an earth-return is used. If this rather unsatisfactory expedient is used, surely less trouble is likely to be experienced from the use of a low-voltage alternating current than from the continuous current with its attendant electrolytic tendencies.

As to the cost of the installation—on any but installations of comparatively large size, the branch cables are selected more from the view point of mechanical strength than from current-carrying capacity, and consequently the increase in cost due to the lower voltage will be small, except in the case of the main cables.

Mr. Fowler's experience with metal-filament lamps would seem to have been obtained with the older "squirted-filament" lamp, as a very wide experience shows that the drawn-wire lamp is certainly not excessively fragile. But any wire, however well made, is naturally increased in strength when it is increased in diameter, and so it stands to reason that the lower-voltage lamps are fundamentally stronger than the higher-voltage lamps of equal candle-power.

Mr. Fowler's knowledge of the conditions of service of metal lamps is amply indicated by the "hedging" which takes place in the latter part of his third paragraph. After having stated that 250-volt lamps are better than 110-volt lamps, he qualifies this by his reference to "traction lamps"—which are only made up to 125 volts.

Admitting the trouble caused by A.C. circuits in conjunction with accumulators—which I cannot see affects the lighting question (except in private supply stations)—my own opinion is that for general "handiness" for lighting purposes, low-voltage A.C. supply is by far superior to high-voltage D.C. supply. When the matter is considered from the point of view of the Electric Supply Co., the advantages of the former system become even more apparent.

The final sentence of the letter under discussion needs no comment, as it is a reiteration of the second paragraph.

**C. A. Hall.**

Monkseaton, *January 28th*, 1915.

---

I have read with interest Mr. Fowler's letter in your issue of January 29th, 1915, *re* lighting installations on the above systems, and would like to offer a few remarks on what Mr. Fowler points out as being the chief trouble with regard to A.C. supply.

Referring to the second paragraph in his letter on A.C. supply, his contention is that there are always two live wires at the point of entry into any room, and that there is always one terminal fully alive, even when the single-pole tumbler switch is off. I presume that by being "fully alive," he means alive at a potential above earth equal to the supply pressure. This difficulty can easily be overcome by permanently earthing one side of the system, and always seeing that the switch is connected in the live side of the circuit.

Take, for instance, a case where three-phase, four-wire, L.T. distribution is in operation, with the neutral or star point permanently earthed, and assuming a two-wire, single-phase lighting supply taken from it, I fail to see why a single-pole tumbler switch, connected in the live side, will not make the circuit dead or at earth potential.

Further, with reference to the last sentence in his letter, *re* D.C. supply, I suppose when he speaks of the live side of a D.C. circuit, he means the outer of a three-wire D.C. system, and the dead or harmless side the neutral of the same system, which is rendered so by permanently earthing at the supply end. What is possible with D.C. in this respect is possible with A.C., as is proved by the extensive use of Stannos copper-sheathed concentric cable for lighting installation work. When installing this, the inner or insulated conductor in a circuit is used as the live or switch wire, and the bare copper sheath or outer conductor is used as the neutral or dead side of the circuit, and is bonded and permanently connected to earth; in many instances, it is laid direct in the plaster on the walls.

I trust Mr. Fowler will agree that what I have said is quite feasible, for I can assure him that the above is now in operation in many towns.

**P. Wardle.**

Carlisle, *January 30th*, 1915.

---

The letter to you of the 8th inst., by "Ex-Gas," in reference to the above, and Mr. Stretton's reply in your issue of the 22nd inst., have been brought to my attention.

The effect of low frequency in causing objectionable fluctuations or flicker on tungsten-filament lamps has received a great deal of investigation, and a number of papers have been presented on this subject before the various engineering societies, particularly the American engineering societies. Mr. John W. Howell, in a paper before the Institute of Electrical Engineers, at New York City, put the practical point of the matter very clearly as follows:—

"The variation of light from a filament due to the variation in current caused by the successive impulses of an alternating current depends upon the heat capacity of the filament, the heat radiating characteristic and the resistance characteristic. Tungsten has a specific gravity about 10 times that of carbon and a specific heat one-fifth as great, so the heat capacity of a tungsten filament is about twice that of a carbon filament of the same dimensions. The heat radiating characteristic of tungsten is better than that of carbon because at a given temperature it radiates heat less rapidly than does carbon.

"The resistance characteristic of tungsten is also more favourable than that of carbon for the retention of energy and heat as the current wave recedes. All these physical characteristics of tungsten are, therefore, better than those of carbon in respect to the retention of heat, and they all tend to make the flicker of tungsten lamps less than that of carbon lamps of the same size filament.

"The actual diameters of tungsten filaments, however, are much smaller than those of carbon filaments of the same candle-power lamps, and this more than offsets the advantages of the other characteristics, for the flickering of tungsten lamps is greater than that of carbon lamps of the same candle power, while it is much less for lamps with the same size filaments."

Taking the matter practically, the question of flicker does not depend on the frequency on the lamp alone, but is very greatly influenced by the area and brightness of the illuminated surface within the field of vision.

As a general rule, Mazda lamps on 25-cycle circuits under ordinary conditions have been satisfactory in respect to flicker. Objectionable flicker increases as the wattage or size of the lamp decreases and the area of light service in the field of vision increases.

A 40-watt lamp, for example, in the centre of a room might show no objectionable flicker on 25 cycles, but the same lamp moved close to a light-coloured wall or ceiling is apt to result in an objectionable flicker effect. The tendency to objectionable flicker under any condition decreases very rapidly as the frequency is increased above the value of 25 cycles, so that on 40 cycles the liability of flicker being noticeable is much reduced. In general, it is desirable to avoid using frequencies as low as 25 cycles for general lighting work.

**F. W. Willcox.**

London, E.C., *January 25th*, 1915.

---

## The Capture of German Foreign Trade.

I hope you will pardon me if I say that your efforts to impress on British electrical traders the importance of getting busy have caused me great amusement.

After some 25 years' Colonial experience of the British trader, the idea of his "capturing" a customer off his own bat is quite beyond belief. The patriotism of the Colonial may cause him to capture the trader, and so leave the latter to flatter himself that "alone he did it," but most decidedly, if precedent goes for anything, the position will not be reversed.

The British trader (electrical and otherwise) suffers from a number of more or less inherited disadvantages. One is his ingrained sense of superiority to the Colonial engineer. Another is his ignorance of what constitutes the British Empire, and the geography of the same. A third is a bland disregard of instructions, and of his customers' wishes generally. I have met many specimens of the British trader during his travels, or mine, and have to admit that he is usually a very fine fellow when once he has got over his surprise at finding that Colonial skins are the same hue as his own; that they speak English without the twang he has read so much about; that they have quite important electrical engineering projects completed or building; and that their knowledge of their profession is not necessarily a minus quantity. Once he has shed the above layers of insulation, he frequently becomes quite human, and even learns to conceal his superiority.

I have mentioned the British trader's ignorance of Colonial geography, which sometimes makes me wonder if maps are published in the British Isles. Here is an instance:—I had occasion recently to write from Dunedin, New Zealand, to a certain advertiser in your paper about his manufactures. He replied stating that Mr. So-and-So, of Geelong, had his agency in Australia, and suggested that I might drop in and see him. As Geelong is about 1,400 miles from Dunedin, and is a small and rather insignificant inland town in Victoria, with a very wet ocean intervening, I had to decline the invitation, and business did not result.

For quite a long time before war broke out I suspected that the British trader was mostly a German. My surmises seem to have been confirmed by the lists I have read in your columns of Germans trading under British names. There were two reasons for my suspicion. One was the unusual consideration given to our orders for material; the other the frequent difficulty in securing sworn declarations that the material was made in England. (These declarations are necessary in order to secure preferential tariff rates.) It is, however, only fair to admit that the neglect to sign declarations is not clear proof of the alien nature of the trader, because the genuine British trader seldom remembers to sign them either until the invoice has been returned to him for that purpose, and a cash deposit paid to the Customs Department at this end, in addition to the general inconvenience experienced.

Recently I sent a fairly large order for some material to one of your really British firms, and instructed them to be very careful to send a small portion of the material per post, otherwise an important contract would be delayed a month. Of course he packed this essential portion, which weighed about 3 lb., with the rest of the goods, and my company will have to wait for over a month for some large payments, due to the non-completion of the contract, which could otherwise have been finished a few days after the arrival of the goods. I need scarcely say that your British trader did not forget to draw on us at sight for his payment—and rightly so. I only mention this last point, because it is about the only one that never is neglected.

Let me give you another instance of your British trader. Some time ago my company ordered several hundred pieces of marble from a well-known firm, and explained that it was for electrical purposes. It duly arrived very badly packed, and was put into use. The first piece erected was a small slab for carrying the fuses for a house-lighting job, and as soon as current (230 volts) was switched on, the main fuses blew right across the terminals. Examination showed a metallic vein joining them. We naturally thought this was a solitary example, but when half-a-dozen other slabs in succession caused insulation troubles we thought it time to examine the rest of the consignment. We then found that every piece without exception was full of metallic veins, and quite useless for electrical purposes, and had to be scrapped. I wrote to the suppliers quite civilly, pointing out that we had ordered marble, and not samples of iron-ore, and that I thought they should replace the consignment sent, and at the same time I ordered a further lot. By the return mail I received a most indignant letter, stating that what I averred was utterly impossible; that they supplied marble to all the largest switchboard makers in England; and, finally, that unless we apologised for our libellous statements they absolutely declined to do further business with us We get our marble from America now.

Once when I was a small boy temptation overcame me, and I swallowed a peppermint that I had promised to safeguard for my sister. To mark the occasion I was sentenced to write out 500 times: "An Englishman's word is his bond" It made quite an impression on me, but nothing to an experience I had last year with another of your enterprising British traders.

A certain problem required to be dealt with, and I sent full particulars to London to a firm that professed to specialise in this particular direction. I stated that we had to give our customer an absolute "no-cure-no-pay" guarantee, and that whatever they recommended and quoted for would have to be guaranteed in turn. They cabled out a quotation in due course. In order to be on the safe side I cabled back asking if they guaranteed the plant, and they replied that they did. To make a long story short, the plant sent was quite inadequate, and we had to spend a large sum of money besides losing all our profit, before fulfilling our guarantee. All this took over a year, and at various times I wrote your British trader (one of the sample British traders who is going to capture the German trade), and received various suggestions, all involving expense, which were carried out. Finally the contract was completed, and I then suggested that as we had entered into the contract in the first place entirely on this British trader's guarantee, he should at least reimburse us for our actual cash-out-of-pocket. I have lately received his refusal, but this time have handed the matter to our solicitors, and I hope you may yet read the details I have omitted—in your journal. "An Englishman's word is his bond"!

Contrast this with the treatment we received from an American firm. We required a certain piece of apparatus for operating on a 230-volt circuit. Unfortunately it arrived wound for 110 volts, and we were put to an expense of about £100 fixing the difficulty up. We reported this to the American maker, and by return received a full apology and a draft for the amount. I have had this sort of treatment several times from American firms.

All the instances given above occurred before the war. Now let me tell you how the British trader proceeded to capture Colonial business from the foreigner as soon as war broke out. It happened that my company had sent orders to England for several thousand pounds' worth of material of all kinds, and most of these orders were actually in hand at the time hostilities commenced. We were notified immediately that orders could not be filled, and where stocks were actually available prices were raised to an exorbitant degree—in some cases even doubled—although they had not cost one single penny more to make, up to then. It was simply a case where supplies were short, and the British trader saw a chance to make a large unearned profit on what he had. Of course I quite recognise that since the war started many articles which depended on Germany for raw material must increase in price. My remarks are confined to material made before the war started.

In New Zealand we have a Customs tariff that gives the British trader a considerable advantage over the effete foreigner. In my opinion it is a mistake, and simply tends to make the British trader lazy. If we trebled the preferential Customs duty, he would just raise his price in proportion, and pocket the extra profit.

I have stated that the British trader does not show consideration for his customers' wishes. I will offer one final example—an experience of a friend of mine. My friend wanted certain articles that are supplied in small wooden cases of somewhat flimsy nature. He has a special use for these cases afterwards, but usually finds that it is impossible to get the nails out without spoiling them. A few months back he was called upon by a British trader and a German. He asked whether these cases could not be supplied with screwed lids. The Britisher said that it would upset the routine of the works, and declined. The German agreed without any demur at all. The order went to Germany.

No doubt it will be objected that I have exaggerated, and shown prejudice in the instances that I have given you of bungling, &c. I can only assure you that my statements are strictly correct. My experience in business has been confined to British and Americans, and I have constantly declined to knowingly do business with Germans for years past, although a much greater profit could often have been made thereby. I have occasionally had German goods landed on me, but that was not my fault, but due to the fact that the British electrical trader appears to have been mostly a German.

The British trader is one everlasting source of exasperation. The American is courteous and considerate, and makes beautiful stuff, in spite of the British belief to the contrary.

If the British trader wants to capture the trade that has hitherto gone to foreign countries, he will have to mend his ways. Holding meetings, passing resolutions, writing to the papers, waiting for business to come to him instead of going after it; wearing a "superior" air; posting catalogues without mentioning the trade discounts; ignoring customers' reasonable (or sometimes even unreasonable) wishes; none of these will do it. When this war is over, Germany will have huge factories simply yelling for work at any price, and on any condition. Then will be the time the British trader will feel the pinch. Let him get busy capturing friends in the meantime. Here is one very willing victim. But I can't picture him doing it.

**Galvo.**

New Zealand, *December 18th*, 1914.

---

## Salaries of Junior Engineers.

I do not think much of "Mr. Experienced's" knowledge of central station practice as exemplified by his ideas of the duties of a shift engineer.

Routine has, of course, some bearing on the matter, but very little. How about coal, oil and water testing; arrangements of labour owing to the absence of an individual; efficiency tests; hourly reading of thermometers for circulation water, flue, boiler, atmospheric, economiser and feed temperatures; observing that the vacuum is maintained at the highest possible and continual testing if vacuum is low; readings for atmospheric humidity; maintenance of $CO_2$ apparatus and proper distribution of fire in grates; observing ammeters and when and where to "split" in case of trouble; getting a feeder on to hospital bus-bars, in case of breakdown, in the minimum of time with the maximum of safety?

Add to this examination and recording of defects in plant, and statistics regarding coal, water and oil used per B.T.U., and it will be seen that there is not much chance either to play cards with the switchman or chat with the driver, and if one did so either all control or organising power would be lost at once, as well as all self-respect. I enclose my card.

**Three to Eleven.**

---

The letter appearing in your issue of January 22nd, signed "Experienced," should undoubtedly be treated with contempt rather than discussion, but the inference drawn from it makes it conclusive that "Experienced" knows very little of his subject. Although this will be apparent to the engineer reader, the ELECTRICAL REVIEW, having a wide circulation, is read, among others, by members of municipal electricity committees.

Often these gentlemen, although successful business men, are not acquainted with the various duties and responsibilities, and the conditions under which the staffs of some of these undertakings work, consequently, "Experienced's" letter needs elucidating. For the benefit of these gentlemen, I would point out that the trained shift engineer, with or without college education, does *not* work by "Rule of thumb," neither is he the frivolous person depicted. He is mostly over the age of 25, and obtains his appointment in open competition. As regards the running of stations by automatic machinery, the introduction of mechanical stokers undoubtedly enables one fireman to work more boilers, yet the possibility of creating smoke and wasting fuel by the unskilled fireman is as great as ever.

Automatic voltage regulators merely dispense with volt boys. Regarding the statement that the real work is upon the station superintendent and his assistants, I should like to know who are his assistants if it is not the shift engineers? Often the superintendent's day is mapped out. He starts at 9 a.m., goes to dinner at 1 p.m., and finishes his day at 5 p.m., and has half-day Saturday and all day Sunday clear. A large portion of his time is occupied in making up works costs and fagging for the assistant engineer. During the most important times of the day these gentlemen are away; then the entire responsibility rests upon the shift engineer. As for the "good steady drivers," their duties consist of starting, stopping and oiling engines. This only occupies a fraction of their time, the rest of which is mostly spent in sitting down, reading and smoking.

The shift engineer's position is mostly one of responsibility without power, and he is for ever between the sandbanks and the deep sea. He is often blamed for the act of a mulish fireman, or an absent-minded driver, or even a fluctuation of pressure due to the fault of a badly-balanced network. The chief, being a busy man, cannot come into contact often with the shift engineers, whose reputation therefore is dependent to a great degree upon those above him, and it is often woe betide the shift engineer who excites their professional jealousy. From a perusal of past correspondence in the Electrical Press generally, the writer is of opinion that relationship, and political and social ties, often loom more prominently in promotion than abilities in some municipal undertakings.

In concluding, I would say to "Experienced" that we shift engineers do not work seven days a week and all holidays, only obtaining time off by working for each other, for fun. I contend that we have much more right to vent our grievance than many an ignorant driver, who knows nothing of the law of Ohm, properties of steam, combustion of fuel, or even the construction of his own engine, whose sole ambition is to spot a winner and who has never spent a copper on a technical journal in his life.

Mr. Ebben's letter, in my opinion, is far too gentlemanly for a Hyde Park oration, and so are the methods of the Association of Electrical Station Engineers. Let us fellow-shiftmen, where we are asked to give our services for a few pence more, or, perhaps, less, than the engine driver or fireman, join one of the great Unions of skilled workers, for it is apparent that only by doing so shall we obtain our emancipation from being

**Slaves of the Lamp.**

---

The following is an extract from a letter I have recently received from a member of the A.E.S.E., which is typical of many others:—"Regarding my subscription, I am so thoroughly disgusted with the 'profession' that I am taking up a clerk's position in a short time and then will not be eligible for membership. After struggling for years on a pittance, I managed to pass the A.M.I.E.E. examination, and still can only earn 35s. per week."

The obvious deduction from this is that the engineer managers of electric supply authorities fail to recognise the examination of the Institution of Electrical Engineers which we have been told should be the *sine qua non* of an electrical engineer. The majority of the engineer managers are members of the I.E.E.; one would almost believe that they had no confidence in their own Institution.

I will say no more at the present critical period of the nation's history, but will leave the foregoing to the conscience of the Institution of Electrical Engineers and that of the engineer managers.

**W. J. Ebben,**

*Hon. Gen. Secretary, A.E.S.E.*

London, N.E., *February 2nd*, 1915.

### Wonderful Accumulator Cells.

Having read "A. W. B.'s" alleged reply to my letter, in which sulphate is as conspicuous by its absence as it is in my test cell, I may presume that my claim is not disputed. To close this rapidly diverging correspondence I offer a four-cell battery made up with celluloid, wood, ebonite and the "wonderful" separators, which, with the exception of the last, will be found, when totally discharged, to sulphate in the order as printed. I decline to be drawn into criticising any matters not appertaining to "A. W. B.'s" original letter.

**A. Faraday Hawdon.**

Newcastle-on-Tyne, *January 25th*, 1915.

["A. W. B.'s" letter was abbreviated by ourselves; it did contain references to sulphate, but as they appeared to be somewhat cryptic, if not incoherent, they were omitted.—Eds Elec. Rev.]

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### New Direct-current Motors.

The British Thomson-Houston Co., Ltd., of Rugby, have introduced a new type of direct-current motor, known as the D.R., in which is incorporated the firm's very extensive experience in this class of work. Commutating poles have been incorporated in the design, giving a wider speed range with field control, and practically sparkless commutation.

The magnetic structure is arranged to render the motors free from objectionable hum, and ventilation is secured by means of a substantially-designed fan mounted at the back of the armature, the air being drawn through radial ducts in the armature core.

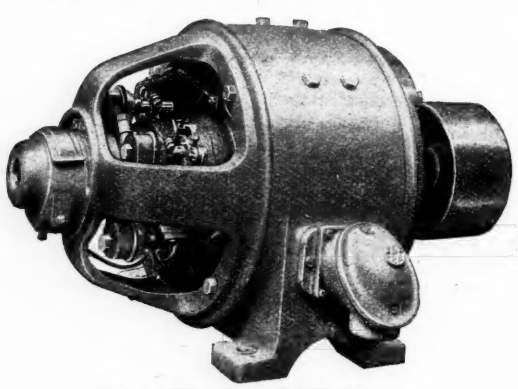


Fig. 1.—New Type B.T.H. Motor.

The commutators are also provided with ventilating ducts. The armature coils are vacuum dried and treated with special moisture and acid proof compound.

All D.R. motors have an overload capacity of 25 per cent. for 30 minutes, and will withstand a momentary overload of 100 per cent. without injurious sparking or heating, whilst all protected

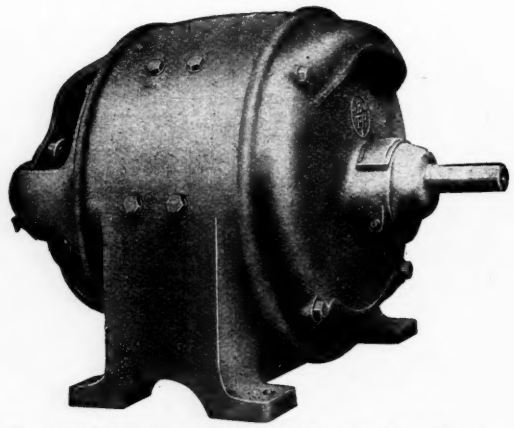


Fig. 2.—B.T.H. Motor showing Hooded End Shield.

enclosed ventilated, drip proof and pipe ventilated type motors will operate for six hours with a maximum temperature rise (measured by thermometer) of 40° C.

The motors can be readily converted into protected, enclosed ventilated or drip proof types by the substitution or removal of covers, while to convert into pipe ventilated, or totally enclosed (water or gas-tight) types, it is only necessary to substitute one or both end shields respectively.

The bearings are carried on the end shields, and the latter can be turned through 90° or 180° to facilitate mounting the motor on the wall or ceiling.

The standard machines are either shunt or compound wound, but series wound motors can be supplied when required, also baseplates for motor generator sets.

### A Series Lighting System.

With the advent of high amperage Mazda half-watt lamps, a large number of existing arc lamps are being replaced, especially for street lighting and similar purposes. In cases where lamps can be arranged to run in short series and where the temporary failure of the series through the breakdown of one of the lamps would not be serious, no special apparatus is required. Where lamps, however, are required to operate in long series, it is necessary to provide suitable apparatus to prevent the sudden extinction of a large number of lamps. The B.T.H. street lighting system provides the following alternatives:—

(*a*) Substitutional resistance with automatic cut-out for each lamp.

(*b*) Automatic constant-current transformer for each circuit with automatic film cut-out for each lamp.

(*c*) Automatic film cut-out only for each lamp.

System (*a*) is expensive where a large number of lamps have to be equipped, and where expense is a barrier, system (*b*) is recommended.

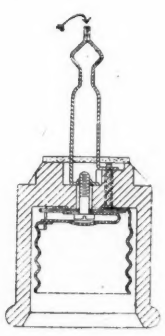


Fig. 3.

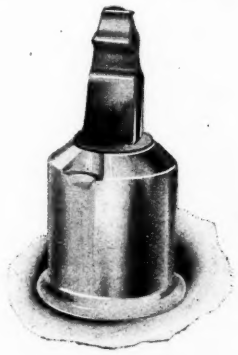


Fig. 4.

Fig. 5.

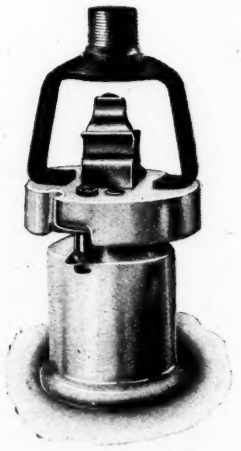


Fig. 6. Fig. 7.

Automatic Film Cut-Out for Half-Watt Lamp.

In system (*c*) a short-circuiting cut-out to each lamp is satisfactory on ordinary circuits, providing that not less than 10 lamps are in the series, or where apparatus can be provided at the central station for plugging in an additional lamp where the ammeter shows that one of the lamps of the series has failed.

The automatic film cut-out referred to above in systems (*b*) and (*c*) is a most interesting accessory, which we have pleasure in describing and illustrating in this article. The disk (fig. 5) consists of two aluminium plates insulated from each other by a piece of chiffon veiling and held together by varnish. These disks will readily break down between 150 and 200 volts, and are placed between the prongs of the holder in the position shown in figs. 3 and 4. Fig. 6 shows the receptacle with the connecting clips. The holder is inserted into this receptacle as shown in fig 7, and can be inserted or removed from the line of circuit without danger from, or interruption to, same. The spring contact of the holder upon removal of the lamp makes contact with the outer shell and completes the circuit, thus enabling a new cut-out to be fixed without puncturing same on replacement.

This interesting device is one of many articles described in price list No. ML 10,480, of the British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C. This price list shows a variety of waterproof lanterns, street lighting fittings, ironclad ship and mill fittings, &c., for Mazda lamps of all types.

### Electric Hand-Grinding Machine.

The electric hand-grinding machine, illustrated in fig. 8, has been designed with a view to obtaining the most practical arrangement of the hand grips, so that the weight of the motor is taken equally on the two hands, whilst at the same time this arrangement permits of the use of the grinding wheel in the most awkward situations. The machines are made for direct

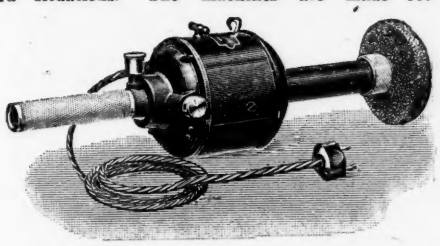


Fig. 8.—Electric Hand-Grinding Machine.

current or for three-phase, the direct-current machine having a ¼-H.P. motor and the three-phase machine a ⅓-H.P. motor. Both are suitable for use with emery wheels up to 4-in. diameter by ½-in. wide. As the machines can be supplied for all ordinary voltages, and are very inexpensive, they are finding some considerable favour in works and in foundries where they are primarily used for finishing off rough castings, and so avoiding much of the labour of chipping and rough filing. The motors are provided with special ball bearings so as to obtain the lightest possible running, and the switch is very conveniently placed on the top of the motor.

Further particulars can be obtained from Messrs. Morris and Lister (London), Ltd., 3, Palace Chambers, Bridge Street, Westminster, or Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster.

### Paragon Earthing Cone.

The Paragon patent earthing cone, which has been introduced by Messrs. Scholey & Co., Ltd., of 56, Victoria Street, S.W., has been widely used abroad. As shown in fig. 9, it consists of a substantially constructed hollow cone made of pure copper, suitably perforated, and filled with small charcoal or coke. Running down through the cone and securely soldered to the copper tip at the bottom is a braided hollow copper cable, into which the earth

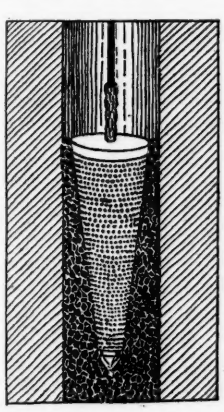


Fig. 9.—Paragon Earthing Cone, as Installed.

wire is soldered. On the top of the cone is placed a copper cap. The dimensions of the cone vary from 1 to 2 ft. in length, and as the width at most is only a few inches it is readily installed at a small cost, a small hole being bored in the ground, and the cone being then surrounded with a mixture of coke and moist earth.

### Beuttell Fittings.

Messrs. A. W. Beuttell, Ltd, have sent us particulars of a number of new patent fittings which they have designed for use with the tubular lamp for shop windows, cornice lighting, &c. The

Fig. 10.—Moulding Strip with Metal Reflector and Corrugated Glass Screen.

essential feature of the Beuttell system is the use of a rectilinear filament as the source of light, which can, of course, be accurately placed at the focus of a suitable reflector—more accurately than a bulb lamp, or any other electric light, except the arc. The focus of a bowl-shaped reflector is necessarily a mathematical point, whereas that of a cylindrical reflector is a line, with which the filament can be made to coincide; thus the optical requirements are strictly complied with in the case of the tube lamp and reflector, and a high degree of concentration of light can be obtained. In recent patterns the reflecting surface, when of silvered glass, has been given a corrugated shape, the corrugations being of defined depth and contour, and disposed

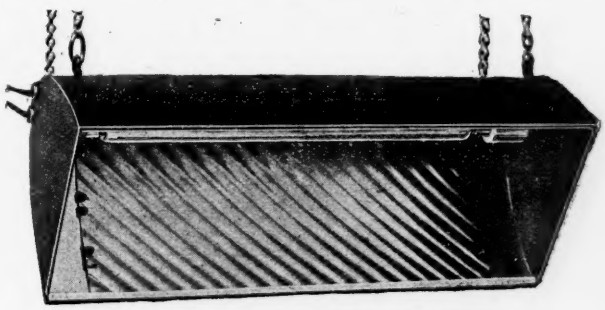


Fig. 11.—Fitting for Shallow Shop Window.

obliquely to the line light source, to prevent the production of streaks; when a plain reflecting surface is used, a corrugated glass screen is interposed in the path of the light rays. The maximum candle-power can be raised to more than five

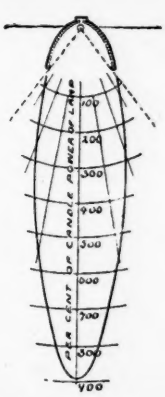



Fig. 12.—Polar Curve.

times the rated C.P. of the lamp. Besides the well-known strip form of fitting, in various patterns, portable fittings for lighting showcases are now made, wood moulding strip (fig. 10), fittings for shop-windows such as that illustrated in fig. 11, theatre footlights, &c. Fig. 12 shows the polar distribution curve for the fitting illustrated in fig. 11.

The fittings are sold by Messrs. Siemens Bros., the Edison and Swan Co, and the Linolite Co., Ltd.

### New Ladder.

Mr. J. H. Heathman, of Parson's Green, Fulham, S.W., has devised an improved patent ladder which can be put to a variety of uses. As shown in fig 13, it consists of a set of three light but strong ladders, which can be used separately or together; two of the ladders can also be fastened together as a self-supporting trestle,

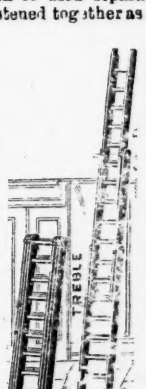



Fig. 13.—Heathman "Treble" Ladders.

and the third ladder can again be attached to these to give additional elevation, after the fashion of a very tall "step-ladder."

### Immersion Heater.

A neat device made by the Electrocalor S.A., of Geneva, Switzerland, has recently been introduced to the English market; it consists of a pair of concentric carbon electrodes enclosed in a per-

forated earthenware sheath, and connected with a flexible cord and plug for attachment to a lampholder.

The circuit is entirely open until the heater (which is called the Thermo Fox) is inserted into a liquid which completes the circuit, and the voltage of the circuit is immaterial. Obviously, in brine or other well-conducting electrolytes the current would be excessive, and therefore, except when water or coffee is to be heated, the heater is enclosed in a nickel-plated jacket filled with water, which prevents the access of the outer solution or liquid to the electrodes. A rubber tube protects the flexible where it is connected to the heater.

The device possesses several novel features, and if used with reasonable care should prove very useful for a variety of purposes. It should be used only on A.C. circuits. The sole agency for this country is in the hands of Mr. E. Meyer, of 62, Grosvenor Road, Highbury, N.

## LEGAL.

### Eydmann *v.* The Premier Accumulator Co., Ltd.

This case came before the Court of Appeal, composed of the Master of the Rolls and Lord Justices Swinfen Eady and Phillimore, upon the appeal of the company (the employers) from the award of the Northampton County Court Judge in a claim made against the company under the Workmen's Compensation Acts by Mrs. Mabel Evelyn Eydmann and her infant children, as the widow and children of Harold Joseph Eydmann, a workman employed by the company.

While packing up lead-lined boxes at the Northampton borough generating station on April 7th last year, through one of the boxes slipping, Eydmann cut his thumb by a projecting piece of lead and septic poisoning set in, with the result that he died on May 31st. The County Court Judge awarded the applicants compensation. The ground of the present appeal was that the proper statutory notice of the accident had not been given, and that the appellants were prejudiced thereby.

At the conclusion of the arguments of counsel, their Lordships allowed the appeal, holding that the employers had not received proper notice of the accident, and that the applicants had not discharged the onus of proving that the employers were not prejudiced by the want of notice.

### Ellis *v.* Faraday & Sons.

In the King's Bench Division, on Monday, February 1st, before Mr. Justice Bailhache and a common jury, an action was brought against defendants, electrical engineers of Wardour Street, W., by Mrs. Maria Ellis, aged 72 years, to recover damages for alleged personal injuries sustained by the negligence of the defendants' servants. The defendants denied liability. The case for the plaintiff was that in January, 1914, she was knocked down by a box tricycle belonging to the defendants and was seriously injured, one of her legs being broken in two places. She was treated at the Middlesex Hospital, and subsequently through the injury to her leg she fell down and broke her right arm. She claimed to recover damages and £65 special expenditure incurred.

Mr. Harold Faraday said that it was suggested to him that £20 should be paid to settle. No agreement was arrived at, and the matter passed into the hands of the solicitors. The jury awarded plaintiff £100 damages. Judgment was entered accordingly.

### Hamilton *v.* Marconi's Telegraph Co., Ltd.

This pending action was mentioned to the Lord Chief Justice in the King's Bench Division and the hearing fixed for February 9th. Mr. Duke, K.C., said he appeared for the defendants and Sir Edward Carson, K.C., was for the plaintiff, and the application was that the case should be fixed for hearing on February 9th.

His Lordship inquired the reason, and was told that if the day was not fixed it might necessitate one counsel giving up his brief, which was undesirable now that the briefs had been read. His Lordship said the case would be in the list for hearing on February 9th.

### Underwood *v.* British Uralite Co., Ltd.

In the City of London Court on January 28th, before his Honour Judge Rentoul, K.C., and a jury, an action was heard in which Mr. A. L. Underwood made a claim against the British Uralite Co., 1903, Ltd., to recover £90 as damages for breach of contract about the purchase of a Bruce Peebles generating set, comprising an engine and dynamo, then at Gravesend.

Mr. C. Doughty and Mr. Macaskie appeared for the plaintiff, and Mr. Morton Smith for the defendants.

Mr. Doughty explained that the plaintiff was a machinery broker and dealer in the City of London, who did a large business in buying machinery and selling it again. The claim raised an important question with regard to the principles on which machinery brokers and dealers dealing in electrical machinery, &c., did their business. There had been several dealings between the plaintiff and defendants. Defendants were in a large way of business, and at Gravesend they had large works. From time to time, no doubt owing to the various processes which the defendant-company were interested in, parts of their machinery became out of date, or they desired to replace them with machinery of more modern type. When that occurred plaintiff had seen them and had found for them purchasers of that machinery. In those dealings it was the custom of the trade for the broker always to buy himself, and himself to sell to his own purchasers. He was not in any sense the real purchaser, in that he did not buy to keep. He always bought to sell, and, as a rule, he did not buy until he had sold on to somebody else. Plaintiff obtained particulars, photos and plans of the particular machinery which it was desired to sell. He then advertised it as if it were his own in all the ordinary trade papers, and being in that line of business all his life he knew through the knowledge he had acquired just where he could place the particular bit of machinery, whereas people like the defendants who might know their own business very well might have machinery on their hands for years because they did not know where to find a market for the machinery which they desired to sell. Plaintiff having found a purchaser then purchased from the defendants. There were occasions if the price was sufficiently tempting, when the plaintiff would himself buy the machinery as a speculation, hoping to find a purchaser afterwards. If he did that the price would have to be very low because there was a risk of putting down a considerable sum of money for heavy machinery, for which one had not an immediate purchaser on the market. The almost invariable custom was to find the purchaser first. That was to the advantage of the seller. If a broker was going to buy as a speculation he did so at a breakdown price. If he had a customer ready he bought at a price which would show a profit. In October defendants had a generating set for generating electricity for sale, and they got into communication with the plaintiff about it. His manager went to Gravesend to take particulars. It was a steam engine and dynamo that was for sale, also other electrical accessories. Plaintiff thought he could place the machinery if he could get an option on it. Defendants gave him an option for a week for the set at £250, thus undertaking not to sell it to anyone else for that time. Then plaintiff advertised it in those channels with which he was very familiar, and sent circulars round describing it. He came into communication in that way with Mr. Martin, a machinery broker in Birmingham, who knew who wanted the set. Correspondence passed between plaintiff and Martin, who knew one another very well. Martin brought to London Mr. Robinson, who was an engineer. Martin and Robinson went to the defendants to see the machine. Plaintiff's option had been renewed. On November 4th the buyer was ready to make a deal. The option for £250 was renewed till November 4th. It was arranged that the plaintiff should, at his own expense, go to Gravesend with the proposed buyer, and he dismantled the machine so that it might be properly examined. Plaintiff's men took down the cylinders and stripped it. It was satisfactory, and Robinson told the plaintiff the deal was as good as complete, but he must see his directors. Martin was going to pay £325 to the plaintiff, and Martin was to make a small commission of £30 from the buyers, whom he had disclosed to the plaintiff. There was no definite contract between the plaintiff and Robinson before November 4th, when the option expired. Therefore plaintiff did not actually accept the offer to buy at £250, because it was not necessary according to the views of all machinery brokers in London. He was confident that the set was as good as sold. Robinson was the engineer to Kynochs, of Birmingham, and he had been sent by them to look at the machine, although it was wanted by the Kynoch Town, near to Gravesend, the manager of which telephoned on November 13th to the defendants in perfect good faith, and said he wanted to speak to them about a generating set which their engineer had inspected. He agreed to buy the set from the defendants at £340, without even looking at it. Defendants accepted it, and the sale took place. Plaintiff was not complaining of Kynochs. Defendants knew perfectly well what they were doing, and made no communication to anyone. A director of Kynochs agreed to buy the set, and wrote to Martin offering £350. Martin telephoned to the plaintiff to say he would buy the set introduced by him. Then the defendants curtly said the set had been sold, and they would not say who were the purchasers. Plaintiff found out that it was Kynochs. Martin began to think that the plaintiff had "sold" him, but that was not so. Plaintiff now claimed his profit as the defendants' behaviour was contrary to all good business dealing and contrary to law.

Mr. Underwood, the plaintiff, was called, and he said there was a custom in the machinery trade for firms who wanted to sell machinery, as defendants did, not to go behind the broker's back and effect a sale, thus saving his commission or profit.

Mr. W. W. Martin, having been called, saying there was a very strict custom that the vendor was not to deal with the purchaser direct,

Mr. M. J. Paley, engineer, Kynoch Town, Stanford-le-Hope, supported the plaintiff's case, as did also Mr. A. G. Brown, of W. & E. Moore, Ltd., Poplar.

For the defence, Mr. Knight, manager to the defendants, said that the plaintiff had only had one previous transaction with them. The custom deposed to by the plaintiff did not exist. They had done nothing to cause the first sale to go off, nor to sell the machinery direct to Kynochs. They had no knowledge who the plaintiff took to Gravesend in the first place, and therefore there was no reason why they should not deal with Kynochs when they came along. Had plaintiff come to them in a proper manner and asked them to meet him, they would have done so. They had not gone behind the plaintiff's back, or done anything dishonourable.

Judge Rentoul, K.C., summed up, and the jury found for the plaintiff for £71. Judgment was entered accordingly, with costs.

A stay of execution was ordered with a view to the defendants

appealing, Mr. Morton Smith remarking that there was no justification for the verdict, having regard to the evidence which had been given.

### Gutmacher *v.* Levy Bros. & Co.

In the City of London Court, on Tuesday, Mr. Edward J. Gutmacher, sales agent for Eastman Electric Machine Co., 1, Talbot Court, Gracechurch Street, sued Messrs. Levy Bros. & Co., 13-17, Goswell Road, for £3 for wiring and fitting up an electric installation for an Eastman electric cloth-cutting machine which plaintiffs sold to the defendants. He said he made an arrangement with the defendants that he should fit up the machine with electricity, and his electrician did the work. That was on October 1st. The work was done the same week. Defendants had sent him a guinea, which he returned as the amount was wholly insufficient. He supplied the machine on trial, and as it was not approved of it was returned. Now he wanted to be paid for fixing the electric installation. The machine was to be fitted free if it was purchased, but it was not.

Mr. F. Boustred, defendants' solicitor, said that as plaintiff told defendants he would have to pay for the installation, they agreed to give him a guinea towards the expenses, not because there was any liability upon them to do so. Plaintiff denied that.

Judge Atherley-Jones found for the plaintiff for 30s., and supposed the decision would not please either party.

### Asuncion Tramway, Light and Power Co., Ltd.: Brazil Railway Co. *v.* The Company and Others.

This debenture-holders' action came before Mr. Justice Sargant in the Chancery Division on Tuesday, February 2nd, on a motion for judgment, in default of defence, the plaintiffs seeking to enforce their debenture security. Mr. Bischoff, for the plaintiffs, said that there was originally opposition by one gentleman, who had put in a defence in which he did not admit the amount of the advances made by the plaintiffs. His Lordship: Some advances were, however, admitted? Mr. Bischoff said yes, and that gentleman now appeared by Mr. Luxmon and did not oppose an order in the terms of the proposed minutes. Mr. H. E. Wright, for the company, raised no opposition to an order being made, and his Lordship pronounced the usual debenture decree directing the usual accounts and inquiries.

### Macdonald *v.* L. & Y. Railway Co.

At the Liverpool Assizes, on January 28th, Mrs. Jane Macdonald, of Waterloo, the wife of an officer on H.M.S. *Carmania*, of the Cunard Line, was awarded £150 damages against the L. & Y. Railway Co. in respect of injuries. The plaintiff boarded an electric train at Bootle, thinking it was going to Waterloo, but the train went on the Aintree line, and, on pulling up at Ford Station, the plaintiff tried to alight. As she was doing so the train was suddenly started, and she was thrown on to the platform. The defence was that the plaintiff found herself in the wrong train, and made a rush to get out of the train when it was moving.

Judgment was entered for the plaintiff for £150.

## OUR LEGAL QUERY COLUMN.

"Electric" writes: "I shall be pleased if you could help me in the following matter:—

"A tenant took a house from me for three years with gas light and asked if I would put electric light in the house. I could not run to this, but he then asked if I would allow him to put it in for his own benefit, this I agreed to. His time is up and he now threatens that unless I pay half the cost of wiring the house he will pull the wires out of the iron tubing.

"1. Please inform me if he can legally do this?

"2. If so, can I make him take away the tubing he has had plastered in the walls, and the switches, and make good with plaster and paper to match, and restore the gas as before, although the fittings were sold for old iron, &c.?"

*** There can be no doubt that where a tenant makes any alterations in the leased premises, the landlord is entitled either to (*a*) call upon him to restore the premises to their original condition, or (*b*) to annex any improvements made without paying the tenant any compensation therefor. In the present case there do not appear to have been any written terms of the letting. A tenant from year to year of a house is only bound to keep it wind and watertight, to use it in a tenant-like manner, and to make fair and tenantable repairs, such as putting in windows or doors that have been broken by him, so as to prevent waste and decay of the premises. He must not commit any waste, but he cannot be compelled to replace doors, windows or stairs worn out with age, or to re-roof the house, renew the main timbers, or execute other general or substantial repairs. Tenants for terms of years are, however, under more extensive obligations to repair, since it appears that they are liable for permissive waste, though tenants for life are not. "Electric" appears to have a tenant for a term of years, and had he put in electrical fittings without leave, he could be called upon to remove them. It is apprehended, however, that the fact of the landlord having given him leave to substitute electricity for gas will now make it difficult for the landlord to call upon him to take out the electric fittings and restore the gaspipes and the premises generally.

"Plume" writes: "I am chairman of a Corporation Electricity Committee. For some years we have been supplying current for photographic printing at power rates. We have now a Local Government auditor. Our town clerk says it is illegal to supply current at power rates for photo-printing, as it is lighting, and not power, and that if we continue the L.G.B. auditor will surcharge us, on the grounds that we are giving preferential terms to one section of tradesmen using light.

"At the last Committee meeting I produced letters from the following Corporations, showing that they all supply current for photo prints at power rates:—Liverpool, Leeds, Manchester, Bradford, Bristol, Birmingham, &c. In answer to these letters the town clerk said it is certainly illegal, but these Corporations have not L.G.B. auditors, otherwise they would not charge at power rates.

"1. Is it illegal to supply current for photo-printing at power rates?

"2. If we supply at power rates, are we liable to be surcharged?

"3. Can you quote any test cases bearing on the point?"

*** As to (1) the problem suggested is one which has never been decided in a Court of Law. It is conceived, however, that although the question is somewhat near the line, the use of electricity for photo-printing is user for lighting, and not for power purposes. In being so used, it is applied to the doing of that which could be better done by ordinary sunlight, and which might be done by gaslight. Moreover, one of the arguments adduced in support of the economic policy of supplying for power at lower rates than for light, is that in the former case the consumer will generally want to be supplied during the day, when the generators might otherwise be idle. Light for photo-printing would, in the ordinary course, be supplied by the sun during the day.

As to (2). In effect, supply at power rates does confer a favour upon a certain class of consumer, and would contravene Sec. 19 of the Electric Lighting Act, 1882, which provides that: "Where a supply of electricity is provided in any part of an area for private purposes, then except in so far as is otherwise provided by the terms of the licence, order, or special Act authorising such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply." Of course it might be argued, in answer to the complaint of an ordinary consumer, that "Plume" was being favoured, that "Plume" was not getting or using electricity "under similar circumstances." But it is apprehended that the broad distinction is between the use of electricity as a means of producing "light," and as a means of transmitting power. As to (3).—See answer to No. 1.

## WAR ITEMS.

**An Open Letter to Germany.**—An electrician writing on board one of His Majesty's ships in the North Sea says:—"Can you not put an open letter to the German Fleet in your next issue? Do they really know how eager we are for a pitched battle?"

**French Government Contracts.**—The Board of Trade desire to draw the attention of manufacturers, merchants and shippers to the following regulations governing the export of articles destined for the use of the French Government:—

1. Application for permission to export to France goods of which the export is prohibited by Proclamation will receive special consideration if it can be clearly shown that the goods are destined for the use directly or indirectly of the French Government. Such applications must be made to the Commission Internationale de Ravitaillement, India House, Kingsway, W.C.

2. Documents issued by provincial military or naval officers, other local authorities, or Government contractors in France will not be recognised as evidence of the destination of the goods unless formally approved in writing by the competent department of the French Government.

3. British manufacturers, merchants and shippers are accordingly warned that, before entering into any contracts for the supply of goods stated to be for the use of the French Government, they should first obtain from their clients written evidence that the approval of the Ministry of War, Ministry of Marine, or other department concerned has been obtained.

4. Application for permission to export the articles in question must then be made in writing to the Commission Internationale de Ravitaillement, accompanied by the necessary documentary evidence. The applicants should not proceed with the execution of the order until they have satisfied themselves that a permit to export will be granted.

Any firms accepting contracts without complying with the above regulations will do so at their own risk and with full knowledge that permission to export the goods which they have contracted to supply may be refused.

E

Applications for permission to export goods which are ordered by firms or individuals in France for purely industrial purposes, and which are not destined for the use of the French Government, will continue to be made in the ordinary manner to the Commissioners of Customs and Excise, Customs House, E.C.

**Mr. Alexander Siemens's Sympathies.**—The "Times" publishes the following letter which was a few days ago addressed by him to the Royal Institution, of which he is secretary. It was read at the meeting of members held on Monday last:—

Caxton House, Westminster, London, S.W.,
February 1st.

It has come to my knowledge that a short declaration on my part, with regard to my position as a British subject, and with regard to my sentiments about the war, would be acceptable to the managers of the Royal Institution. I, therefore, venture to lay before you the following statement:—

I have been born in Hanover, both my parents having been British subjects until Hanover was separated from the United Kingdom in accordance with the provisions of the Salic Law.

In the year 1866 the kingdom of Hanover was annexed by Prussia, and thereby universal military service was introduced.

In July, 1867, I first came to England, and I went back to Germany in 1868 to absolve my military duties, but I was not accepted on account of my shortsightedness. I had, however, to present myself again, when the war against France broke out in July, 1870, and I joined a regiment of the Line for one year.

In October, 1871, I returned to London, where I have resided ever since.

As it became probable that I should spend my life in this country, I resolved to follow the example of the late Sir William Siemens by becoming a naturalized British subject.

To carry out this plan I obtained my formal release from German citizenship in March, 1878, and my certificate of naturalization (No. 2,671) was filed at the Home Office on August 16th, 1878.

Thus I have been a subject of the kingdom of Hanover for 19 years, of Prussia for 12 years, most of which time I spent in Germany, and of the United Kingdom for over 36 years, nearly all of which I spent in London.

As a consequence my sympathies in this war are entirely on the side of the Allies, and I cannot express strongly enough my abhorrence of the way in which Germany has disregarded international treaties and conventions, as to the conduct of hostilities, and more particularly of the raids made on unfortified watering-places in this country.

I should like to add that in return for the advantages I have enjoyed as a British subject, I have done my best to serve this country whenever an opportunity for doing so presented itself to me.

ALEX. SIEMENS.

The above statement by Mr. Siemens may be described as characteristically conscientious. It entirely confirms the opinion that we ourselves and a host of other admirers had formed of the writer during his 36 years' residence in this country in intimate and eminent connection with British electrical and engineering affairs.

**German Engineers and their Prospects.**—The official journal of the Association of German Engineers and Technicists, in a retrospect of the year 1914, reviews the effects of the war upon the prospects of German trained engineers and technical men. The review is written in a somewhat chastened style, contrasting agreeably with the We-are-the-Victorious-Elect bombast of the German generals and professors. "We are unable," says the paper, "nor do we wish at the present time, to probe the causes of this bloody war. But we must take account of the facts of the present conflict, no matter what may be our individual convictions on the question of the war itself. It is certain that the wholesale destruction of life of the world-war cannot be reconciled with our ideas of humanity. Yet, no abandonment of the struggle now begun is possible which would endanger German civilisation and German economic life. The civilisation of our country must not be destroyed, nor its economic strength shattered. The future of all technical employés in particular is bound up with a result of the war that shall be favourable for Germany. If Germany at the mercy of our enemies, were broken up not only territorially but also economically, it is the men of our profession who would be the worst sufferers. An economically vigorous German industry is the necessary premise for the social advancement of our members."—"Ironmonger."

**British Aluminium Employés.**—In connection with the British Aluminium Co., Ltd., an illuminated roll of honour has been prepared, bearing the names, ranks, and regiments of the employés who have enlisted, and surmounted by a pictorial representation of the rally to the flag. From the factories at Kinlochleven, Foyers, Burntisland, Milton, Larne Harbour, and Warrington, and from the head office, the total enlistments are 462. The Scottish regiments have claimed many of the recruits, the Argyll and Sutherland Highlanders having the honour of the highest individual total of all (66). The list includes the name of an officer in a French infantry regiment. The navy is also well represented.

**Accrington Electricity Employés.**—The Chairman of Accrington Electricity Committee reports that several of the specially trained staff are desirous of joining the colours, in addition to those who have already done so. As their places would be extremely difficult to fill, he has sought the Council's opinion as to what course should be taken. The question is now under consideration.

**Silvertown War Relief Fund.**—The employés of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd. have subscribed £537 13s. 3d. in the last 21 weeks to the National Relief Fund, British Red Cross Society, and Belgian Relief Fund, and we understand that they hope to continue to distribute £100 monthly between these three funds for as long as may be necessary.

**Personal.**—Mr. W. J. Leeming, electrical engineer to the Buxton U.D.C., who has joined the Forces, has been presented by the staff with a set of hair brushes in a leather case. During his absence his duties will be undertaken by Mr. Copland, M.I.E.E., at Mr. Leeming's present salary, less £2 per week payable to Mr. Leeming, and with permission to continue his consulting work.

The Burnley Electricity Committee has decided that it cannot see its way to consenting to the enlistment of Mr. Starkie (electrical engineer), Mr. Taylor (assistant engineer), and Mr. G. D. Clegg (switchboard attendant).

Temporary Lieut. L. B. Hogarth, of the 11th Border Regiment, who, as announced in the "London Gazette," has been gazetted Temporary Captain, was, prior to the outbreak of war, electrical engineer at Whitehaven, having previously occupied the position of borough electrical engineer at Morecambe.

Mr. B. James, electrician, Glasbury, has joined the Military Wing of the Royal Flying Corps.

Mr. W. E. Jewell, electrical assistant to Mr. C. Jones, electrical engineer to the Metropolitan Railway, has joined His Majesty's Forces as Captain (Pioneer) in the 16th Royal Irish Rifles, and is at present stationed at Lurgan near Belfast.

Mr. J. Pendreich, of the Pendreich Electrical Firm, Edinburgh, has been with the Expeditionary Force since the commencement of hostilities. His address is:—Corpl. J. Pendreich, Army Service Corps, c/o Requisitioning Officer, 8th Infantry Brigade, 3rd Division, British Expeditionary Force.

In the "London Gazette" list of aliens to whom certificates of naturalisation have been granted lately the following appear:—

Wm. Sylvester de Ropp, Russia, electrical engineer, Kensington, London.

Geo. Henry Funck, Germany, director of the Lubricating and Fuel Oils, Ltd., Westminster, London.

Jean Baptiste Annibal Légé, France, engineer and scientific instrument maker, Chelsea, London.

Otto Jens Marstrand, U.S.A., assistant to a civil engineer, South Norwood, London.

**Roll of Honour.**—A report presented recently to the Bradford Tramways Committee shows that no fewer than 187 men from the department have been engaged in active service on the Continent. The following employés of the Department have been killed:—Conductor A. Eushworth, Cleaner W. E. Harvey, Driver J. Kemp, Conductor J. Bamford, Conductor A. Padfield, and Conductor G. Garnham. The following have been wounded:—Conductor J. Craven, Conductor A. Conderson, Conductor M. Ratcliffe, Cleaner C. Bennett, Conductor J. Holdsworth, Flagman H. Walker, Driver P. Parker, Driver J. Boothman, Driver P. Walker, Conductor H. R. Smith, Conductor H. Enderby, Conductor A. Morton, Conductor H. Lea, Conductor A. Cryer, Conductor A. Bernhardt, Conductor W. Lane, Conductor C. Dennison, Conductor E. Clubley, Cleaner J. McIver, Conductor H. Hoste, Cleaner J. Corey, and Driver W. S. Marshall. Conductors A. E. Marsden and W. Challis, and P. Binns (labourer) are prisoners in Germany.

---

**Keeping Turbine Blades Clean.**—Impure water, even **though treated, is sometimes the cause of a fine coating of lime forming on turbine blades. Lime, magnesia and graphite carried over with steam from water used in the boilers at Leavenworth, Kan., formed an objectionable coating on the blades of the turbine, making it quite a task to keep the machine clean. But now, since it has been found that kerosene injected into the steam line will clean the blades, the turbine gives no more trouble. At a convenient spot in the steam line between the throttle and the valve rigging a small hand-pressure pump has been installed through which kerosene may be injected. Entering thus with the live steam, the oil particles are driven against all blades, and only an occasional injection from the pump is needed to keep the blades bright and clean.**—*Electrical World.*

**X-rays and Contraband.**—At Boston, U.S.A., every **bale of wool or cotton loaded for shipment to Germany is being subjected to an X-ray test for the prevention of the exportation of arms or other contraband that might be concealed inside. Representatives of the British Consulate are present with United States Customs officers to make assurance doubly sure.**

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### New Australian Tariff.

We reprint from the Sydney *Daily Telegraph* certain portions of the new Excise Tariff which may be of interest to our readers; our contemporary considers that the most pronounced feature is the extended charges against goods other than of British manufacture:—

| | Produce of U.K. | General tariff. |
|---|---|---|
| Tariff items (in some cases the old tariff is given in brackets)— | | |
| Copper wire, bars, plates, rods, tubes; lead sheet, piping; platinum bars, rods, strips; zinc bars, sheet; iron and steel tubes and pipes (except riveted or cast), ad. val. ... | Free | 10 % |
| Rails, fishplates, bolts, ties, rods, switches, crossings, &c., for tramways or railways; rolled iron or steel joists, columns (not drilled), per ton... ... ... ... ... | 17s. 6d. | 25s. |
| Steam engine indicators, revolution counters, &c., ad. val. ... ... ... ... ... | Free | 10 % |
| Rock boring, drilling, and coal-cutting machines, ad. val. ... ... ... ... | 25 % | 30 % |
| Motive power machinery and appliances (except electric), viz.:— | | |
| (*a*) Economisers; mechanical stokers; steam traps; steam turbines; superheaters; water purifiers, ad val. ... ... (Free, 5 %) | Free | 10 % |
| (*b*) High-speed reciprocating steam engines for direct coupling or directly coupled to electric generators or to pumps, subject to Departmental By-laws, ad val. ... (Free, 5 %) | 25 % | 30 % |
| (*c*) N.E.I., ad val. ... ... ...(20 %, 20 %) | 25 % | 30 % |
| Electrical machines and appliances:— | | |
| (*a*) Electric heating and cooking appliances, ad val. ... ... ... ...(10 %, 15 %) | 10 % | 20 % |
| (*b*) Electric fittings consisting wholly or partly of metal, viz.:—Switches, fuses, and lightning arresters, ad val. ... ... (Free, free) | 20 % | 30 % |
| (*c*) Regulating, starting, and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards and telephone distributing boards, ad val. ... ...(20 %, 20 %) | 20 % | 30 % |
| (*d*) Dynamo-electric machines; static transformers and induction coils for all purposes; electric fans, ad val. ... ...(20 %, 25 %) | 25 % | 30 % |
| (*e*) Electric fittings not containing metal to be dutiable according to material. | | |
| Electrical appliances, viz:— | | |
| (*a*) Telephones, telephone switchboards, telephone distributing boards, and appliances, ad val. ... ... ... ... ... ... | Free | 10 % |
| (*b*) Electroliers; chandeliers; pendants; brackets; zinc tubing, ad val. ... ... ... | 25 % | 30 % |
| (*c*) N.E.I., ad val. ... ... ... ... ... | 20 % | 25 % |
| Electrical articles and materials, viz.:— | | |
| (*a*) Accumulators or storage batteries; arc lamps; cable and wire (covered); carbon in blocks of 12 sq. in. and over; electric vacuum tubes; measuring and recording instruments; prepared insulating tape; anodes, cathodes, and hooks for plating purposes, ad val. (Free, 5 %) | Free | 10 % |
| (*b*) Arc lamp carbons, ad val. ... (Free, 10 %) | Free | 10 % |
| Lamps and lanterns; lampware, but not columns of street lamps, ad val. ... ... ... ... | 15 % | 25 % |
| Glass parts of lamps separately imported, ad val. | 20 % | 25 % |
| Miners' safety lamps, ad val. ... ... ... | Free | 10 % |
| Glass cells for batteries, ad val. ... ... ... | Free | 5 % |
| China and porcelain ware, ad val. ... ... | 20 % | 25 % |
| Kinematographs, ad val. ... ... ... ... | 25 % | 35 % |
| Rubber manufactures, in which rubber forms a part, ad val. ... ... ... ... ... | 25 % | 35 % |
| Chassis for electric railway and tramway vehicles, ad val. ... ... ... ... ... ... | 25 % | 30 % |
| Bodies for ditto, ad val. ... ... ... ... | 35 % | 45 % |
| Chassis for vehicles with self-contained power (electricity), not including rubber tires, ad val. | Free | 10 % |
| Bodies for vehicles with self-contained power (electricity), including dashboards, footboards and mudguards:— | | |
| Single-seated bodies, each ... ... ... | £15 | £17 |
| Double „ „ „ each ... ... ... | £21 | £24 10s. |
| Bodies with fixed or movable canopy tops, each ... ... ... ... ... ... | £36 | £42 |
| Vehicles, n.e.i., ad val. ... ... ... ... | 35 % | 45 % |
| Thermit and other welding compounds, ad val. ... | 20 % | 25 % |
| Scientific, surgical, dental (electrical) instruments and appliances; machinery for educational use ... ... ... ... ... ... | Free | Free |

## BUSINESS NOTES.

**Consular Notes.**—TASMANIA.—*Hydro-electric Installation.*—The United States Consul at Hobart reports that the Government have purchased the partly-completed hydro-electric plant at Great Lake, about 60 miles from Hobart, and propose spending £100,000 at once towards it completion. A company has been working on this scheme for several years, and after spending nearly £500,000, had to cease work on account of lack of funds. It is intended to develop cheap power at Great Lake and transmit it to all parts of the State for industrial and lighting purposes. Most of the material and machinery necessary for this enterprise has been obtained. It is also proposed to spend over £400,000 upon railway and tramway construction work. While it is likely there may be some deductions therefrom, the United States Consul considers it practically certain that there will be much activity in this line of work during the current year, and that the demand upon foreign sources for all material necessary for such work, except sleepers, will be brisk. Such work is usually done by day labour under charge of the engineers of the State Railway Department.

BAGDAD.—*The Tramway and Lighting Scheme.*—The United States Consul at Bagdad reports the presence in that city of two surveyors who have been engaged in laying out the route for the proposed electric tramway. They were sent by the British interests controlling the concession, as a definite step to develop this enterprise. One of the chief hindrances to the construction of the tramway has been the narrowness of the Bagdad streets. The surveyors have now been ascertaining how many, and which, buildings must be removed, and what such removal would cost. In addition to the concession for the tramway, the same interests are reported to have secured a concession for the erection of an electric lighting plant in Bagdad. Before the introduction of the crude-oil engine the price of coal in Bagdad (53s. to 70s. per ton) contributed toward making the installation of an electric plant a precarious venture from a financial point of view; but if an electric lighting and power plant using oil for fuel can be built in connection with the tramway, much of this uncertainty would be removed, provided the first cost of installation (including street widenings for the tramways) does not prove to be excessive.

LISBON.—*Railway Electrification.*—The United States Consul-General at Lisbon reports the signature of a decree by the President of the Portuguese Republic for the electrification and lease of the railway connecting Lisbon with Cascais. The line is about 16 miles long and is owned by the Portuguese Railway Co. It serves the so-called Riviera of Portugal and, in the Consul's opinion, should be a paying investment. It is proposed to run electric trains every half hour and to make the entire run in 25 minutes.

SEVILLE.—*Tramway Extension.*—Writing on the subject of tramway extension at Seville, the American Consul there says that the river driveway in the direction of Palmera has undergone such changes during the past few years, with many new houses built in the Avenida de la Reina Victoria, that the Seville Tramway Co. have decided to extend their line to meet the needs of that neighbourhood. It is rumoured that work is about to commence on a new bull ring to seat 4,000 persons at Tabladilla, which will probably serve as an incentive to the early completion of the projected tramway extension. It is anticipated that the construction of this tramway will do a great deal towards urbanising the avenue mentioned, and that further improvements will result.

NORWAY.—*Electrical Manufacture.*—According to a recent report by the United States Consul at Christiania, motor factories in Norway are developing rapidly, many of them having been enlarged during the past 12 months, and new ones established. A number of these factories have been joined in a union called A/S Det Forenede Motorfabriker (United Motor Factories), with headquarters at Bergen. Norwegian motor factories are in close competition with the Swedish, Danish and American manufacturers. Manufacturers of electrical machines and apparatus had a successful year. One of the largest manufacturers in this line, specialising in telephone apparatus, established a branch factory in Italy.

KWANGTUNG.—In July last a contract was let to a Hong-Kong firm for the erection of a small electric light plant at Kongmoon, Kwangtung Province, China. The contract called for Swedish engines and German dynamos and fittings. The United States Consul reports that as a result of the war the machinery has not arrived, and, in his opinion, the course of prices is such that it is likely the contract will be annulled.

**Book Notices.**—The *Practical Engineer Electrical Pocket Book and Diary* (London: Technical Publishing Co., Ltd., price 1s. 3d. post free) has been issued for 1915, with additions relating to electric motors, fuses, and wireless telegraphy; other features have been improved, and the useful lists of books appended to the various sections have been revised. A lengthy section is devoted to Acts of Parliament and Official Rules and Regulations, including those relating to electricity on board ship.

"Alternating Current Electricity." By W. H Timbie and H. H. Higbie. London: Chapman & Hall. Price 8s. 6d. net.

**Trade Announcements.**—Mr. J. Brooke, electrical engineer, of 9, Cross Street, Wakefield, is retiring from business.

Messrs. Fyfe, Wilson & Co., of 155A, St. Vincent Street, Glasgow, inform us that they have secured the sole selling rights for the world of "Quartowatt" non-luminous heaters, which are manufactured in Glasgow.

**Private Arrangements.**—The Altheat Co., Ltd., 62, Oxford Street, London, W.—In pursuance of the provisions of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held on Monday, at the offices of the liquidator, Mr. A. Slatter, 62, Oxford Street, W. The liquidator stated that the liabilities of the company amounted to £370, although that amount might be slightly increased. The assets consisted of stock and book debts £346, estimated to realise £268. A lot of the goods possessed by the company consisted of gas and electric radiators, which had been sold on sale or return. There were no unpaid calls in arrears. The company was a private concern and was formed to develop patent gas stoves and electric radiators. They had been put on a commercial basis, and last July negotiations were proceeding for the formation of a company, with a capital of £15,000. Those negotiations were put a stop to by the war. The company was formed in 1912, with a nominal capital of £5,000. Shares of the value of £2,000 were issued to the vendor (Dr. Wild) for his patents. Of the remaining 3,000 shares all but about £700 worth were subscribed for. In answer to questions the liquidator stated that sums amounting to £300 had been loaned to the company, and charges given on the patents. There was also a sum of £80 at the bank, which was likewise subject to the charge. The opinion was expressed by creditors that the whole of the charges on the patents could not hold good as against the creditors, and the liquidator said he himself was of the opinion that one charge for £150 could not be enforced. After shortly discussing the position the creditors decided that an application should be made to the Court for the appointment of Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C., to act as joint liquidator with Mr. Slatter in the winding up of the company. The liquidator stated that negotiations were in progress for the sale of the electric radiator patents, and for a reconstruction of the gas part of the business. The principal creditors are:—

| | |
|---|---|
| Shaw & Hobbs, Birmingham .. .. .. .. .. | £43 |
| Coalbrookdale Co., London .. .. .. .. .. | 134 |
| Phillips & Co., London .. .. .. .. .. .. | 26 |
| Bullen & Co., London .. .. .. .. .. .. | 15 |

**Stoker Contracts.**—Among the more important orders recently received by the Underfeed Stoker Co., Ltd., are the following:—

War Office, Waltham Abbey, 4 B.; Charing Cross, West End and City electric supply department (repeat), 2 E.; Edinburgh Corporation electricity department (repeat), 8 D.; Barrow-in-Furness electricity department (repeat), 2 E.; Borough of Sunderland electricity department (repeat), 1 E.

Several orders have recently been received by Messrs. Ed. Bennis & Co., Ltd., for re-linking chain-grate stokers of another make with their patent chain-grate link. Among such orders is one from the Powell Duffryn Steam Coal Co., Ltd., Middle Duffryn power station, Mountain Ash, another from the British Xylonite Co., Ltd., Brantham Works, near Manningtree, and a third from the West Ham Corporation electricity station.

**Catalogues and Lists.**—Messrs. Scholey & Co., Ltd, 56, Victoria Street, Westminster, London, S.W.—8-page pamphlet entitled "How to Save Money in the Boiler-house," containing a description, with illustrations and diagrams, of the Cope's boiler-feed-regulator.

Messrs. Stewarts & Lloyds Ltd., Winchester House, London, E.C.—42-page catalogue of Stewarts' patent steel pipes for gas, water, sewage, &c. Excellent photographic reproductions are shown of pipes in course of laying in Ceylon, Australia and elsewhere, and interesting information is given on such matters as the cost of laying, corrosion, protective coating, steel *versus* C.I. pipes; there is also a standard specification for lap-welded steel pipes.

Messrs. Kohler Bros. (incorporated with Crompton & Co., Ltd.), 56, Ludgate Hill, London, E.C.—8-page illustrated list describing the 'Standard" type Kohler electric printing machinery system, two and four-motor drive, and giving a list of prominent newspaper offices where it is in use.

Messrs. Alfred Herbert, Ltd., Coventry.—Monthly machine tool review for January.

**Liquidations.**—The Universal Belting Co., Ltd.—A meeting will be held at 8, St. James's Square, Manchester, on March 6th, to hear an account of the winding up from the liquidator, Mr. J. A. Ashley.

Premier Lighting and Engineering Co, Ltd.—Mr. E. H. Hawkins, of 4, Charterhouse Square, E.C., has been appointed an additional liquidator in the voluntary winding up.

Acton Lamp Co, Ltd.—Mr. Justice Joyce has appointed Mr. J. Gibson Harris, F.C.A., Receiver and manager on behalf of the debenture-holders of this company, with power to carry on the business.

Tannett Walker & Co., Ltd., Hunslet, Leeds.—First meetings of creditors and contributories February 11th, at Leeds Law Institution, 1A, Albion Place, Leeds.

**Bankruptcy Proceedings.**—T. M. Woodcock, electrical engineer, Sheffield.—Trustee, (Mr. J. C. Clegg, Official Receiver, Figtree Lane, Sheffield), released December 21st, 1914.

H. H. Oxley (O. Huxley), consulting engineer, Hanwell.—A first dividend of 1s. 8d. in the £ is payable on February 3rd, at the office of the Official Receiver, 14, Bedford Row, W.C.

W. H. Pease, electrical engineer, Scarborough.—A first and final dividend of 5¼d. in the £ is payable on February 2nd, at the Official Receiver's offices, 14, Figtree Lane, Sheffield.

J. G. M. Hilton, electrical engineer, Birmingham.—Last day for proofs for dividend February 17th. Trustee, Mr. A. S. Cully. Official Receiver, 191, Corporation Street, Birmingham.

**New Zealand.**—An Auckland firm is inquiring for British agencies for c.i. pipes, water meters, oil engines, motor-cars and accessories, and electrical goods of all kinds. Communications should be addressed to H.M. Trade Commissioner for New Zealand, P.O. Box 369, Wellington.—*B. of T. Journal.*

**Tiflis.**—A local merchant who has hitherto imported from Germany is inquiring for British agencies for scientific instruments, steelware, and electrical appliances. Further communications should be sent to the British Consulate at Tiflis.—*B. of T. Journal.*

**Netherlands.**—There is stated to be a demand in the Netherlands at present for electric wire and cable. Communications should be addressed to the British Consulate-General, Rotterdam.—*Board of Trade Journal.*

**For Sale.**—Aberdeen electricity department invites offers for the following second-hand plant: Two 100 K.V.A. Brush motor-generators complete; Stockton-on-Tees electricity department have for disposal one 150-KW. Brush 'Universal" vertical reciprocating engine. Particulars are given in our advertisement pages to-day.

**Calendar.**—From Mr. K. C. Inouye, of 169, Motomachi Ichichome, Yokohama, contracting agent of the Yokohama Electric Co., Ltd, we have received a wall calendar with daily slips for 1915.

## LIGHTING and POWER NOTES

**Aberdeen.**—The Electricity Committee reports that 1,315,900 units were generated in December last, against 1,203,850 in December of the previous year, an increase of 85,050 units.

**Accrington.**—Gas Engine Trials.—The Electricity Committee has declined to accede to a request from Messrs. Peebles & Son, Ltd., for a reduction of the price charged for electric current supplied to them under their agreement.

The borough electrical engineer reports that the second of the new gas-engine generators has been run on trials, and that it is hoped to put it into normal use in a few days. The new gas-making and by-product plant is working satisfactorily. All the 1914 contract machinery is working, with the exception of a few auxiliaries, and these will be rapidly put in working order.

**Australia.**—The Doncaster (Vic.) Council has decided to float a loan of £2,000 for the purpose of installing an electric lighting scheme in the shire.

**Barrow.**—The Electricity Committee has decided to provide a supply of current to the Corporation gasworks for stand-by plant.

**Belfast.**—The Council, on the recommendation of the Tramways and Electricity Committee, has appointed a Committee, with the electrical engineer, to visit Bradford, Sheffield, Leeds and Greenwich, to obtain information as to administration and other matters relating to the electrical undertaking.

**Bispham.**—New Loan.—The U.D.C. has decided to increase to £320 the amount for which the L.G.B.'s sanction has been asked in connection with the laying of electric lighting mains along Blackpool Road, this being the difference between the cost of overhead work and underground cables.

**Blackpool.**—Proposed Loan.—Application is to be made for L.G.B. sanction to the borrowing of £24,500 for electricity extensions.

**Blackrock.**—L.G.B. Inquiry.—On January 26th an inquiry was held into the application of the local U.D.C. for a loan of £13,000 for an electricity scheme. Evidence was given by Mr. Tierney, engineer of the scheme, and Mr. Spencer Hawes, who advocated Blackrock having its own scheme in preference to joining with Kingstown.

**Brighouse.**—Electric *v.* Steam Drive.—The Sewage Committee of the T.C. reports that as a result of substituting electricity for steam for driving the lime crusher at the sewage works, the saving for the past 12 months had been £180. The wages bill had been reduced; energy had cost £54 as against £94 the average cost of coal for the past four years, also 75 hours per week had been worked as against 57 previously.

**Brymbo.**—E.L. Scheme.—The Lighting Committee has received the consent of the Public Works Loan Commissioners to borrowing £300 for the proposed electric lighting scheme. The tender of Messrs. Loxley & Co. has been recommended for acceptance, and a meeting is to be called to determine the rate to be charged for the work which is to be carried out at once.

**Chelmsford.**—Restricted Lighting.—The Lighting Committee of the T.C. recommends that £200 be deducted from £417, the amount of the Electric Supply Corporation's account for the quarter, owing to the restricted lighting, and that the question of the amount of the rebate be considered at a future meeting.

**Chile.**—Messrs. Oscar Spoerer & Co. have permission to install an electric lighting system at the port of Tolcahuano.

**Chorley.**—WORKHOUSE LIGHTING.—A deputation from the B. of G. is to visit Ormskirk workhouse to obtain particulars of the electrical installation in vogue for heating, lighting and power purposes.

**Cleckheaton.**—BULK SUPPLY PROPOSAL.—The Electricity Committee of the D.C. has decided not to take a supplementary bulk supply from the Yorkshire Electric Power Co.'s station at Thornhill.

The scheme adopted for the extension of the electricity works, at a cost of £8,500, was deferred in order to consider the Yorkshire E.P. Co.'s offer.

**Connah's Quay.**—PROV. ORDER.—The Council is to apply to the B. of T. for a prov. order in connection with the proposed electric lighting scheme; there are only two objectors, viz, the G.C.R. Co. and the Connah's Quay Gas and Water Co., and it has been decided to proceed with the scheme at once.

**Continental.**—NORWAY.—The Government has for years been buying up waterfalls in the various parts of the country with a view to keeping some in reserve and harnessing them as required. Last year the State acquired in all six waterfalls or large water rights, which purchase involved a total capital expenditure of £15,400, and in this year's budget there is included a sum of £5,500 for the same purpose, which most probably will be exceeded. The State has now become the owner of 38 waterfalls in all, which in unharnessed condition are estimated to represent a total of 156,490 electrical H.P. When the water is regulated and harnessed this amount will be brought up to 776,080 H.P.

In regard to the situation of these waterfalls 12,800 H.P. are located in the interior of the country, and a long distance from the sea, for which reason it is not possible to transmit the energy to the coast, and it will have to be employed for local purposes in the surrounding districts; 464,900 H.P. are, however, to be derived from waterfalls, from which energy can with advantage be transmitted to the coast; 100,420 H.P. have been bought up for the express purpose of supplying the necessary energy to the railways when these are electrified.

The remaining 197,600 are to be produced in falls which are situated in the direct vicinity of the coast.

The concessions given to private companies, and which are completed, number five in all. These are two concessions to the Rjukan Co. and one each to the Norwegian Electrical Metal Industry, the Moelven Pulp Manufactory and the Arendal Smelting Works, from which the State has derived fees amounting to £4,000 up to the present time.

GERMANY.—According to the *Electrical Review and Western Electrician*, a proposal has been submitted to the Prussian Ministry and the chief of the province of East Prussia suggesting the allocation of State funds for the electrification of the province, which has suffered severe damage. The dearth of labour and scarcity of horses will be obstacles in the way of revival of trade, and it is held that the use of electric power would be a remedy.

**Cuba.**—The *Gaceta Oficial* (Havana) announces that the following persons have been granted permission to install electric generating and lighting plant in Cuba:—Senor Eduardo R. Valera, at the town of Catalina de Güines, Province of Havana; Senor Manuel Andujar, at Báez, Province of Santa Clara; Senor Isidro Rovira, at Cabanas, Province of Pinar del Rio; Senor Donato Hernandez, at Arriete and Ciego Montero, Province of Santa Clara. In each case the concession will be rescinded if the plant is not in working order within a year from the date of the concession. —*Board of Trade Journal.*

**Doncaster.**—HIRING CLAUSES.—A poll of the burgesses on the trading clauses of the Corporation's Parliamentary Bill resulted as follows:—For Clause 129, which gives the Corporation power to let on hire electric appliances, &c., 796; against, 1,291.

**Dublin.**—The Lord Mayor, at a meeting of the City Electricity Committee, expressed regret that the past year's working of the undertaking had not been as satisfactory as had been hoped, the trading having been seriously affected by the war and other matters outside their control. The Lighting Committee, in a report to the Corporation, asked for the amalgamation of that Committee with the Electricity Committee, to avoid overlapping of work. The growth of the electricity concern may, it is thought, make it necessary to use the Tara Street premises as a distributing station.

ASYLUM LIGHTING.—Mr. R. Jones, chairman, at a meeting of the Richmond Asylum Joint Committee, mentioned that the saving on the substitution of electric light for gas in the institution more than paid all the annual charges and repayment of capital of the new installation.

**Dundalk.**—The Council's electric lighting scheme is now making a profit. There was a loss on the first nine months' working of £163, and also a slight loss on the second year's working.

**Erith.**—The Woolwich borough electrical engineer has asked the Erith Council to consider the question of taking a bulk supply of electricity from the Woolwich Council or to allow it to supply current in the Erith district. The matter was deferred until after the appointment of the new engineer.

**Eccles.**—PUBLIC LIGHTING.—The borough electrical engineer is to submit an estimate of the cost of the Barrow system of electric lighting, as carried out on the length of tramway track from Swinton to Irlams-o'-th'-Height.

The Electricity Supply Committee of the Corporation has received an inquiry for terms for supplying electricity to the Manchester Ship Canal landing stage at Irwell Park, and has replied that it will be in a position to consider terms for supply on receiving from the company its decision in regard to the Committee's application for permission to take water from the canal for condensing purposes.

**Greenock.**—NEW LOANS.—The Corporation has decided to apply to the Scottish Office for permission to borrow an additional £20,000 for extensions. The T.C.'s plant represents a total capacity of 11,900 KW., of which 9,000 KW. is modern A.C. plant, and it will be impossible to meet the obligations of the department next winter without an additional 5,000-KW. set. The £20,000 proposed to be borrowed is to be expended on the purchase of a new turbo-generator of 5,000-KW. capacity.

**Haslingden.**—NEW LOANS.—Application is to be made to the L.G.B. for sanction to the borrowing of £7,500 for the provision of mains, £1,500 for services, and £3,000 for the provision of transformers, switchgear, &c., making £12,000 in all.

The Corporation has decided to supply electricity to the works of the Nobles Explosives Co., and Messrs. Haworth & Hartley.

So long as the public hall is used as a military hospital, a discount of one-third will be allowed off the charges for electricity.

**Haworth.**—The U.D.C. has decided to oppose the Yorkshire E.P. Co.'s proposed Bill.

**Horrabridge.**—E.L. SCHEME.—The inauguration of the electric supply scheme took place last week; the installation, carried out by Messrs. Crompton & Co., includes a 25-H.P. Blackstone engine, coupled to a 15-KW. dynamo; a 12-H.P. water turbine, coupled to a 7-KW. dynamo; and a 200-ampere D.P. storage battery. Electricity is distributed by overhead wires to all parts of the village. Some 20 lamps, each of 50 C.P., are in use for street lighting.

**Keighley.**—The R.D.C. has decided to petition against the Yorkshire Electric Power Bill. With reference to the Keighley prov. order formal objection has been lodged and the Board has appointed representatives to meet a Committee of the Keighley Corporation with reference to the terms of the order.

**Leigh-on-Sea.**—PUBLIC LIGHTING.—Preparations are to be made by the Southend-on-Sea T.C. for installing the electric light at the Broadway, a business centre. Leigh is now comprised in the borough.

**Lexden and Winstree.**—WORKHOUSE LIGHTING.—The B. of G. was informed that there had been a decrease in the cost of electricity during the past three months, and that in another 12 months the Board would have saved enough on electricity to defray the cost of the plant.

**Limerick.**—L.G.B. INQUIRY.—On January 22nd, Mr. A. D. Price, L.G.B. Inspector, held an inquiry into an application by the Corporation for a loan of £5,000 for the purpose of providing additional plant at the electric power station.

**Liverpool.**—ANNUAL REPORT.—The City Council has received sanction to borrow £40,000 for the provision of electric mains. The city electrical engineer, in his report on the estimates for 1915, remarks that during the past year the reconstruction of the Lister Drive, No. 1 station, has made satisfactory progress, and the first section of the boiler house has been completed, and the whole plant put in commercial service with very satisfactory results. The first of the 6,000-KW. sets has been run, and the second set is being assembled and will be completed very shortly. The engineer is of opinion that it would be advisable to deal with a portion of the plant in the destructor stations which has been in use for a considerable period, and has under consideration a scheme to replace some of these sets with plant of modern construction, and he has made provision for this work in the estimates. During the past year several trials have been made with electrical vehicles, and a 2-ton vehicle has been ordered to be used in connection with the cartage of mains' materials, stores, &c.

**London.**—The annual meeting of the Metropolitan Boroughs' Standing Joint Committee has decided to ask the City and Borough Councils to request their Members of Parliament to oppose the London Electric Supply (No. 2) Bill.

L.C.C. BILL DROPPED.—At Tuesday's meeting of the L.C.C. the London and District Electricity Supply Bill, which has aroused so much opposition in the municipal circles interested, in and round London, failed to receive the necessary majority to enable it to proceed in the present session of Parliament. A total of 69 votes was necessary in favour of the Bill, but the voting was 61 in favour and 32 against, 14 Reform members being absent on active service. Sir John Benn, while admitting the technical part of the scheme was satisfactory, said the financial part was disastrous. Mr. Norman pointed out that if the scheme was abandoned, the Bill of the companies would hold the Parliamentary field.

Bethnal Green.—The B.C. has been recommended to oppose the London Electric Supply Bill. The Electricity Committee has approved plans of the electricity sub-stations proposed to be erected at New Tyssen and Digby Streets.

Marylebone.—It is proposed to apply to the L.C.C. for sanction to borrow £6,500, in connection with the installation of trunk feeder protective apparatus.

**Luton.**—Street Lighting.—The Lighting Committee of the T.C. has considered the question of discontinuing the lighting of streets by electric lamps and reverting to gas lighting, but has postponed further consideration of the matter until its next meeting, in order that the borough engineer may furnish particulars of the annual expenditure in lighting streets by electricity.

**Maidstone.**—New Turbine Plant.—The Electricity Committee recommends that a 1,000-kw. turbo-alternator be installed, at a cost of £5,300, and also that notice be given to large consumers that owing to the great increase in the cost of coal it may be necessary to raise the price of current as from January 1st under new contracts.

**Newbury.**—Hospital Lighting.—It has been decided to have the electric light installed at the Isolation Hospital.

**Oldham.**—Supply of Motors.—Representatives of the Chamber of Trade have interviewed the chairman of the Electricity Committee of the Corporation, who explained the difficulty under which the department laboured in its endeavour to extend the use of electricity, and that no encouragement was given to people to apply to it, and only in certain cases had it supplied motors, when it was feared the business would be lost. The interview closed with an arrangement by which the members of the trade would co-operate with the department in extending the use of electricity in other directions.

**Ormskirk.**—At a meeting of ratepayers on January 29th it was unanimously decided to petition the U.D.C. urging opposition to the Ormskirk Gas and Electricity Bill, which the Ormskirk Gas Light Co. has promoted.

**Penistone.**—Workhouse Lighting.—The L.G.B. has sanctioned an expenditure of £124 for lighting the workhouse premises by electricity.

**Peterborough.**—Improved Working.—The revenue from the electricity works for December last was £1,299, as against £1,144 the previous year, and the surplus £828, as against £616. The engineer reported that the cost of production had been reduced from 9d. per unit to 7·6d., a reduction of 16 per cent. in generation costs, due to the greater efficiency of the turbo-generator and mechanical stokers, the whole of the new plant having been in use throughout the month.

**Reigate.**—Prov. Order.—The R.D.C. has decided to consent to the application of Mr. Gilbert Allom for a prov. order for E.L. at Chipstead.

**Salford.**—Sewage Pumping, &c.—A report with reference to the provision of electrically-driven pumping plant at the sewage works, has been approved. The T.C. has been recommended to authorise the purchase of an additional turbine-driven boiler-feed water pump and feed-water heater at the electricity station.

At the recent Council meeting a resolution was to be brought forward to the effect that a Special Committee be appointed to control the lighting of the borough, and that the Committee should consist of four members of the Electricity Committee, four members of the Gas Committee, along with six other members of the Council.

**Southampton.**—Tariffs.—The electrical engineer has reported upon the suggested adoption of a different type of charge for domestic purposes, *i.e.*, a fixed charge per annum based upon the rateable value of the premises (or upon the kw. installed) plus ½d. per unit metered, but does not recommend any alterations in the charges at the present time, in view of the fact that it had recently been decided that the flat rate was the most suitable for the town. The Council has agreed with the views of the engineer.

**Stalybridge.**—The Generating Station Committee of the Joint Board has authorised the engineer to spend not more than £25 on experimental lighting of workmen's dwellings.

The price of electricity for heating and cooking purposes has been fixed at ¾d. per unit net, subject to a meter rent of 6d. per quarter.

**Stoke-on-Trent.**—The L.G.B. has informed the Electricity Committee of the T.C. that it is not prepared to sanction a further loan in respect of land for the power house, and asking what steps the Council proposes to take with regard to the overdraft on revenue account of £6,890 on March 31st last. The Committee has decided to give an undertaking to liquidate the overdraft referred to during the next three years. The Finance Committee recommends the town clerk to try and arrange with the Board that the three years shall commence upon the termination of the war.

**Swansea.**—The Estates Committee has recommended the extension of a lease to a local timber merchant subject to his using electric power instead of suction gas, as to which complaints have been made. It was urged that this was a form of coercion, but eventually the Committee's recommendation was adopted.

**Sunderland.** — Receipts and Estimates. — The estimates of the Corporation supply undertaking for the year ending March, 1915, show a probable income of £65,801, as compared with £67,514 the previous year, made up as follows:—Power and heating, £33,610; private lighting and heating, £18,115; tramways, £11,339; sales department, £4,000; and public lighting, £2,735. The working expenses are estimated at £36,122, compared with £36,221 last year, the net revenue being £35,933, as against £37,296. After repayment of loans, interest and other outstanding charges the balance remaining of £6,852 will be placed to the renewals fund.

**Surrey.**—The County Council has unanimously decided to oppose the London Electric Supply Bill; the Richmond T.C. has already decided to petition against it.

**Warrington.**—School Lighting.—The Electricity and Tramways Committee's offer to provide electricity to Oakwood Avenue Council School, upon a guaranteed revenue of £50, has been accepted by the Education Committee.

**Willesden.**—The Electricity Committee of the U.D.C., reporting upon the effect of the war upon the amount of electricity used, stated that in the Christmas quarter of 1914 the number of units used was 1,387,533 as compared with 1,431,374 in 1913 and 1,211,760 in 1912.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—Tramway Purchase.—The Corporation Tramways Committee, having under consideration the proposed purchase of the Suburban Co.'s system, has agreed to obtain the advice of Mr. Dalrymple as to the value of the undertaking.

**Argentina.**—The City and Suburbs of Buenos Aires Tramways Co., concessionaires of a tramway line from the municipal boundary to the Tigre, recently notified the Government of the Province of Buenos Aires that they found it impossible to comply with the requirement of the concession that the works of the first section should be terminated within 15 months. They therefore asked to be allowed 18 months, and the Provincial Government has accorded the extension of time asked for. —*Review of River Plate.*

**Barnsley.**—B. of T. Report.—Lieut.-Col. von Donop, in reporting on the tramway accident which occurred on December 2nd—which was reported in our pages at the time, and was due to the conductor of a car which was standing on a falling gradient, releasing the brakes by mistake when the driver was absent, thus allowing the car to run away down the hill—attributes it to want of care and promptitude on the part of the driver and conductor. The former he holds largely responsible, while the latter failed, apparently without reason, to apply the hand or slipper brakes from his end of the car. The inspector points out, however, that the short length of 1 in 50 gradient is not a suitable place for a tramway terminus, and that the driver should not be allowed to leave his car when it is standing there.

**Barrow.**—The T.C. has decided to urge upon the British Electric Traction Co. the necessity for increasing the number of electric tramway-cars at Barrow, the renewal of defective points, and greater passing place accommodation on the Abbey Road route.

**Blackpool.**—The Corporation proposes to borrow £675 for the purchase of four top-deck covers for tramcars.

**Burnley.**—A Sub-Committee is considering the application of the tramway employés for permission to form a rifle club at the depôt.

**Continental.** — Norway. — The electrification of the railway between Kiruna and the Riksgränsen Station on the Norwegian frontier has now been completed, and traffic was opened on January 19th. Loaded trains of 40 wagons are run at a speed of 60 km. per hour; previously the highest speed allowed was only 27 km. The work has been successfully carried out, although accompanied by some mishaps, among which may be mentioned that the telegraph line from Sweden to Narvik has been put out of service altogether, due to induction effects. Steps have now been taken to lay a double telegraph line. The telephone line is a double line supplied with discharging poles and transformers, and the induction on this is very small.

Prof. Pleyl and Engineer Holmgreen, of Stockholm, have now solved the problem in regard to induction as far as the telegraph line is concerned.

**Edinburgh.**—Tramway Extensions.—The Tramway Committee has considered the proposals of the County Council with regard to the proposed tramways in the city's prov. order. In the case of the Corstorphine extension there appears to be little difficulty in the way of an agreement between parties, and it is hoped that the line, the construction of which has become a pressing need since the opening of the Zoological Park, will be laid down. In regard to the Colinton-Craig Lockhart extension, difficulties have arisen regarding road widening. Recent developments in the Colinton district have shown need for transport facilities.

**Eccles.**—A Sub-Committee of the Salford Corporation is considering terms upon which the latter would be prepared to undertake liability for the repair and maintenance of the overhead tramway electrical equipment.

**Halifax.**—NINE MONTHS' WORKING.—For the nine months ending December 31st, the income from the tramways was £87,907, and the expenditure £75,972, leaving a profit of £11,935.

**India.**—The Railway Board has decided to equip all passenger trains with electric light and to discontinue the use of gas for train lighting. Electric lighting is exclusively used on some of the narrow gauge lines.

**London.**—"BAKERLOO" EXTENSION OPENED.—On Sunday last the greater part of the Queen's Park extension of the "Bakerloo" tube was opened for traffic, the line being completed, although the Queen's Park station is not yet available for use, so that a temporary terminus for passengers has been made at the preceding station, Kilburn Park, the other intervening stations to Paddington being Maida Vale and Warwick Avenue. All the stations are equipped with escalators between the booking halls and platforms below. The new line runs out into the open near Queen's Park, the last quarter mile being beside the North-Western line. Automatic and semi-automatic signalling on the McKenzie, Holland & Westinghouse Co.'s electro-pneumatic system has been installed, similar to that in use on the older section of the line, except that A.C. track circuits have been adopted. Ultimately it is intended to run four through trains an hour over the new line between Watford and the Elephant and Castle Station (the South London terminus), and there will also be numerous connections at Queen's Park between the North-Western Co.'s Watford service and the tube service, terminating at Queen's Park. At an inspection of the line on Friday last, four all-steel cars were used, fitted with a special system of radially opening doors, with safety indicators under the gateman's observation.

**Manchester.**—TRAMWAY EXTENSIONS.—The Tramways Committee has intimated its willingness to pay the extra cost of an additional strip of land to be acquired for the purpose of widening the proposed new Southern Road from 80 to 108 ft., the object of the Committee being to have this additional strip specially reserved for tramway purposes on which a special type of tramway track would be constructed which would enable better transit facilities to be provided. It is recommended that steps be taken with a view to an application being made to Parliament for an extension of time for the construction of tramways in Stretford and Davyhulme, authorised by the Manchester Southern Tramways Act, 1903.

The all-night car service, which has now been in operation more than a year, and which has proved a great boon to night workers, is to be continued for another year.

**Newcastle.**—FEMALE CONDUCTORS.—At a meeting of the Tramways Committee on January 28th, the general manager remarked on the scarcity of men in the city, and said that with the sanction of the Committee he was contemplating employing female conductors on some of the quieter routes. The matter will probably be brought forward at the next meeting of the Committee.

**Rochdale.**—TRAMWAY ACCIDENT.—A collision occurred on January 27th between two tramway cars in Whitworth Road; both drivers' platforms were crushed and the drivers pinned against their control apparatus and seriously injured. Two passengers also complained of injury.

**South Shields.**—A TRAMWAY PROPOSAL.—An interesting proposal, brought before the Tramways Committee, is an extension of the system by incorporating with it the system of the Jarrow and South Shields Light Railway Co., which extends from Jarrow to Tyne Dock in South Shields, where it joins the system of the Corporation. The matter is still in embryo, but it is understood that shortly a deputation will wait upon the Jarrow Corporation to ascertain its views on the matter. About a dozen or more years ago the present proposal formed part of the scheme of the then South Shields Tramways Co., whose complete scheme included a line southwards to Sunderland, while other sections of what was practically the same scheme were intended to connect Jarrow with other towns on Tyneside, and, through Gateshead, westward with some of the colliery districts adjoining the latter borough. The ballot at South Shields as to the promotion of a Parliamentary Bill for (*inter alia*) tramway extensions, resulted in 2,376 voting for the proposal, and 1,180 against it, so that the Bill will be proceeded with.

**Stalybridge.**—PROPOSED TRAMWAYS.—The Ashton-under-Lyne T.C. and Denton, Audenshaw, and Limehurst D.C.'s have each decided to oppose in Parliament the Bill promoted by the Stalybridge Joint Tramways Board, one of the objects of which is to take over the tramways of the Oldham, Ashton and Hyde Electric Tramways Co., whose lease will shortly expire. The Parliamentary Bill is also being opposed by the Town Councils of Dukinfield and Mossley (who are part owners of the Joint Board Tramways), on the ground that the proposed extension of the tramways in the direction of Glossop is not required.

The Joint Board at a meeting on January 28th confirmed the promotion of the Bill. The General Purposes Committee has decided to insert a clause to the effect that no project for the supply of electricity or tramway service outside the four boroughs—Stalybridge, Hyde, Mossley and Dukinfield—be proceeded with unless two-thirds of the members of the Board vote in favour.

**Sunderland.**—TRAMWAY EXTENSIONS.—The estimates for the year ending March 31st, 1915, show an anticipated total revenue of £74,882, compared with £75,226 (actual) for the previous year. The expenditure is put down at £42,246 for working expenses, and there is a balance of £32,636 to carry to the net revenue account. From the net revenue account £10,374 will be taken for the payment of loans, and £6,463 for interest, £1,217 for income-tax, £8,145 for the reserve and renewals fund, and £5,000 for the relief of the rates. This latter is the same amount as has been devoted for that purpose for several years.

**U.S.A.**—CO-OPERATIVE ELECTRIC VEHICLE GARAGES.—A scheme that is expected to give an impetus to the adoption of the pleasure type of electric motor vehicle is at present being developed by the New York Electric Vehicle Association. It is that of establishing a co-operative garage in the West-end of New York, specially adapted to the storage and maintenance of this type of automobile, at a uniform charge of £9 per month, this charge to also include the cost of the current required for the charging of the batteries, and the cleaning of the vehicles. In connection with the garage a showroom is to be established in which the cars made by the firms co-operating in the enterprise will be offered for sale.

## TELEGRAPH and TELEPHONE NOTES.

**Illicit Wireless Installations.**—At Wood Green Police Court, on January 29th, S. W. White, 17, a wireless telegraph student, was charged with having in his possession, without the written permission of the Postmaster-General, a complete wireless installation. The accused was remanded on bail.

**Long-Distance Telephony.**—Telephonic communication has been inaugurated between Washington and San Francisco, *viâ* New York and *viâ* Boston, a distance of about 5,000 miles. The feat was made possible by loading the line with Pupin coils.

**Telephonic Interruptions.**—It is stated that the storm last month brought down more than 12,000 wires in London and the South of England—mainly in South London, where the service taken over from the National Telephone Co. is on the overhead system. The snow fell in a damp, clinging condition, and accumulated on the wires, afterwards freezing, and under these conditions a breeze brings them down wholesale. Owing to the shortage of labour, great difficulty has been experienced in repairing the damage, and it will take a considerable time to complete the work of restoration.

It is stated that 80 per cent. of the overhead lines south of the river broke down, and the storm was the worst on record in this respect. The snow formed a coating 1½ in. thick on the wires.

As 1,000 out of the normal staff of 4,000 men had enlisted, the Post Office engineers were severely handicapped, and were glad to have the assistance of 100 skilled linemen from the Royal Engineers, lent by the War Office.

**The Telegraphic Union.**—The *Journal Télégraphique*, the official organ of the International Bureau of the Telegraphic Union, at Berne, had to suspend publication in August last, but has resumed its activities with the issue for January 25th.

**United States.**—The Marconi Wireless Telegraph Co. of America, states that the trans-Atlantic high-power stations at New Brunswick, N.J., and Belmar, N.J., were completed and were being tested out when the European war interfered with the work, the English Government having commandeered the corresponding stations at Carnarvon and Towyn, Wales. The trans-Pacific service was opened on September 24th, and uninterrupted communication is being maintained with Honolulu. Within a few months the company's high-power stations in Massachusetts—the transmitting station in Marion and the receiving station in Chatham—will be complete and ready for service with Norway, Russia and Northern Europe. The Japanese station, which is to work in connection with the trans-Pacific system, will be ready at the end of April and will thus complete the trans-Pacific link.—*Telegraph and Telephone Age.*

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—March 6th. U.D.C. Twelve months' supply of cables, meters, joint-boxes, &c., lamps, uniforms, tickets and other stores. See "Official Notices" to-day.

**Australia.**—BRISBANE.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

MELBOURNE.—March 16th. White Wheatstone receiving tape, for Postmaster-General. See "Official Notices" to-day.

**Aylesbury.**—February 6th. U.D.C. Supply of electric motors to consumers (hire-purchase agreement). See "Official Notices" January 22nd.

**Bedwas.**—March 4th. Electrical goods for 12 months, for the Bedwas Navigation Colliery Co., Ltd. Forms of tender from the Secretary.

**Belfast.**—February 10th. Twelve months' supply of electric lamps, carbons, fittings, batteries, &c., for the Midland Railway Co. Northern Counties Committee (Ireland). Forms of tender from Mr. Ellis, Stores Superintendent, York Road Station, Belfast.

**Birkenhead.**—February 8th. Corporation. Twelve months' supply of electrical and tramway stores. Forms of tender from Mr. G. P. Shallcross, Borough Electrical Engineer, Craven Street.

**Blackburn.**—February 13th. Corporation. Twelve months' supply of stores, including a number of electrical items, for the Electricity Committee. See "Official Notices" Jan. 29th.

**Blackpool.**—February 17th. Corporation. Uniform clothing for tramway traffic staff. Traffic Superintendent's office, Blundell Street depôt.

**Bolton.**—February 11th. Corporation. Low-tension sub-station switchgear, for the Electricity Department. See "Official Notices" January 8th.

February 22nd. Corporation. Twelve months' supply of stores, for the Tramways Committee. See "Official Notices" to-day.

**Bristol.**—February 11th. Twelve months' supply of carbons, joint, junction and fuse boxes, wattmeters, ampere-hour meters, boiler castings, globes, &c. See "Official Notices" Jan. 29th.

**Cardiff.**—February 22nd. Installation, 750 points, at New Technical Institute, Cathays Park, for the City Council. See "Official Notices" January 22nd.

**Colchester.**—February 6th. Corporation. Twelve months' supply of stores, including lighting fittings, car equipment, overhead equipment, cable, &c. See "Official Notices" January 22nd.

**Glasgow.**—The General Finance Committee of the T.C. has remitted to ex-Bailie Arch. Campbell and the Superintendent of Clocks to arrange for the renewal of the electric clock batteries in connection with the installation of electric clocks in the north-western district of the city.

**Gloucester.**—April 1st. Twelve months' supply of stores, for the Electricity and Light Railways Committee. Forms of tender from Mr. F. H. Corson, General Manager, Light Railways Offices, Bristol Road.

**Halifax.**—February 15th. Corporation. Twelve months' supply of stores, including lighting fittings and electrical accessories, cables, telephone wire, meters, &c. See "Official Notices" January 22nd.

**Ilford.**—February 23rd. U.D.C. Twelve months' supply of stores for the electricity works. See "Official Notices" to-day.

**Llandudno.**—February 12th. U.D.C. 440-B.H.P. compound condensing steam engine, and 300-KW. multipolar dynamo, &c. Particulars from the Clerk, Town Hall.

**Leeds.**—February 20th. Corporation. Twelve months' supply of stores, including cable, mains boxes and fittings, jointing and insulating material, electric lamps, fittings, &c., for Electric Lighting Department. See "Official Notices" January 22nd.

February 17th. Electrical work, Hough Lane School, Bramley, for the Education Committee. Education Architect.

**London.**—BERMONDSEY.—February 5th. B.C. Twelve months' supply of carbons and brushes, cable and jointing material, stoneware conduits, meters, demand indicators, main fuses, oils, meter boards, street frames, covers and joint-boxes. See "Official Notices" January 22nd.

L.C.C.—February 10th. Installation (184 wiring points, 246 lighting points) at Scawfell Street Elementary School, Hackney. See "Official Notices" January 29th.

H.M. OFFICE OF WORKS.—February 12th. Cylinder and machinery oils for one year. Controller of Supplies, 18, Queen Anne's Gate, S.W.

ISLINGTON.—February 24th. Twelve months' supply of electrical stores, for the B.C. See "Official Notices" to-day.

ST. PANCRAS.—February 15th. B.C. Arc lamp carbons, for the Electricity Department. See "Official Notices" January 29th.

ST. MARYLEBONE.—February 17th. Stores, including meter-boards, casings, &c., cables, box compound and insulating materials, &c., for Electricity Department. See "Official Notices" Jan. 29th.

**Manchester.**—February 16th. Corporation. Twelve months' supply of stores for the Tramway Department. See "Official Notices" January 29th.

**Newcastle-under-Lyme.**—February 5th. Three-wire single, L.T. paper, lead-covered cable, armoured feeder and distributor mains, for the Electricity Department. See "Official Notices" January 22nd.

**Portsmouth.**—February 16th. Corporation. Six months' supply of stores, for the Tramway Committee. See "Official Notices" to-day.

**Rotherham.**—February 22nd. Corporation. Two water-tube boilers, automatic mechanical stokers, economisers, superheaters, foundations, steel chimneys, steam valves, steam pipes, induced-draught plants, and all auxiliaries. See "Official Notices" January 29th.

**Southend-on-Sea.**—February 5th. Corporation. 140 tons of Sandberg steel rails and fishplates (specifications, &c., £2 2s., returnable), and 26 steel poles with brackets and scrolls. Mr. E. J. Elford, Borough Engineer, Clarence Road.

**Spain.**—February 15th. The municipal authorities of Prat del Llobregat (province of Barcelona) are inviting tenders for the concession for the electric lighting of the town during a period of 15 years.

February 18th. Tenders are being invited by the municipal authorities of Canalejas de Penafiel (province of Valladolid) for the concession for the electric lighting of the town.

**Stockton-on-Tees.**—February 19th. Corporation. Two 500-KW. rotary converters, transformers and starting apparatus. See "Official Notices" to-day.

**Swindon.**—February 17th. Corporation. Four-way and other stoneware conduits, for the Electricity and Tramway Department. See "Official Notices" to-day.

---

## CLOSED.

**Bolton.**—The Electricity Committee has accepted the tender of Mr. Wm. Gornall for the construction of the Bradshaw-gate sub-station.

**Delagoa Bay.**—A contract for 12 months' supply of direct-current ampere-hour meters to the Delagoa Bay Development Corporation has been placed with the Electrical Apparatus Co., Ltd.

**Glasgow.**—The Tramways Committee recommends acceptance of the following tenders:—

Commutators.—P. R. Jackson & Co., Ltd.
Lead-covered cables.—J. Hally Craig.
Motor armature coils.—Manchester Armature Repair Co.
D.C.C. wire.—B.I. & Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.

The Committee has accepted the offer of the Otis Elevator Co., Ltd., for a new goods elevator in the extension of the head office, and an alteration on the existing passenger lift at the head office.

The Clyde Navigation Trustees have accepted the offer of the St. Helens Cable Co., Ltd., for the supply of electric cable.

**Huddersfield.**—The Electrical Apparatus Co., Ltd., has received a contract for 1,000 single-phase meters for the Corporation.

**Hull.**—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., amounting to £135, for three motors (10 H.P.), for driving the machinery in the new workshops, has been accepted by the Corporation Tramways Committee.

**Leyton.**—The tender of Mr. R. H. Bacon has been accepted by the U.D.C., at £125 10s., for work at the water-cooling tower.

Having regard to the present difficulty in the supply of materials, the Urban District Council has decided, in connection with the contracts expiring on March 31st next, to obtain quotations for a six months' supply only of service-line cable and arc lamp carbons. With regard to engine oils, the Electrical Engineer has been directed to communicate with the present contractors with a view to the renewal of their contracts upon the same terms. Messrs. W. Cory & Sons, contractors for the supply of slack coal to the electricity works, cannot now undertake to supply at contract price up to more than 50 or 60 per cent. of the quantities ordered. The firm offers to make up the balance with other equal nutty slack at a price which is 2s. above the contract rates. Having regard to the fact that no good purpose would be served by inviting tenders (the present contract expiring on March 31st next), the Electrical Engineer has been authorised to make the best arrangements he can with the present contractors or others for the supply of the slack.

**Liverpool.**—The City Council has been recommended to accept the following tenders:—

Sutton Heath and Lea Green Collieries Co., Ltd.—Annual supply of best quality steam slack.
Walter Scott, Ltd.—2,500 tons, Sandberg silicon steel tramway rails, 131 lb. per lineal yard; 200 tons, Sandberg silicon steel tramway rails, 130 lb. per lineal yard, for curves; and 40 tons, fishplates.
Hadfields, Ltd.—100 tons tie-bars.

**London.**—SHOREDITCH.—The Electricity Committee has received the following tenders for the supply of lead-covered, paper-insulated single and twin cable required for services during the period ending March, 1915 :—

| | ·0024 sq. in., single. | ·035 sq. in., single. | ·095 sq. in., single. | ·0234 sq. in., twin. | |
|---|---|---|---|---|---|
| **Siemens Bros. & Co., Ltd.** (accepted) | £70 | £87 | £127 | £185 | Per mile. |
| Western Electric Co., Ltd. .. .. | 71 | 88 | 178 | 187 | |
| W. T. Henley's Tele. Works Co., Ltd... | 72 | 89 | 180 | 180 | |
| W. T. Glover & Co., Ltd. .. .. .. | 72 | 90 | 179 | 187 | |
| B.I. & Helsby Cables, Ltd... .. .. | 72 | 90 | 182 | 192 | |

To be in accordance with the specification of the British Engineering Standards Committee, and, as regards the single cable, suitable for a working pressure of 660 volts D.C, and the twin cable 1,100 volts D.C.

HAMMERSMITH.—The Electricity Committee reports that four tenders only were received for the supply of mechanical stoker coal for a period of one to three years, and in each case the tenderers added conditions which made the acceptance of the tenders without value. In these circumstances, and with the object of increasing and maintaining the coal reserve, the Committee has authorised the borough electrical engineer, in consultation with the chairman and, where possible, with the Committee, to accept satisfactory offers of coal up to 3 000 tons, advantage being taken as far as possible of the prices offered by the tenderers.

STEPNEY.—The B.C. Electricity Committee reports the purchase of 4,300 tons of coal for the electricity undertaking in lots of 100 to 500 tons, at prices ranging from 8s. 9d. to 19s. 6d. per ton ; also the acceptance of the offer of Messrs. Foster & Co. to supply 100 tons per week of Kingsbury fine slack coal at 10s. 1d. per ton for 12 months from February 1st, for the Limehouse generating station. The Borough Electrical Engineer reports that the British Central Electrical Co., Ltd., have informed him that, as the French Government have prohibited the exportation of carbons, they are unable to carry out their tender for 10,000 pairs of carbons accepted by the Council on January 6th. The Committee reports that, on the advice of the Electrical Engineer, it recommends the acceptance of the quotation of Messrs. Geipel & Co. to supply 10,000 pairs of carbons of the National Carbon Co.'s make, at £12 15s. per 1,000 pairs, the order to be placed as and when required. The Committee also reports the acceptance of the offer of Messrs. W. Geipel & Co. for 7,000 pairs of flame arc carbons, at 18s. per 100 pairs.

L.C.C.—A contract for the supply of electric lamps (Schedule No. 17) has been placed with the Edison & Swan United Electric Light Co., Ltd. Items 8 to 27 (metallic-filament lamps with filaments of "drawn" wire in one continuous length).

**Manchester.**—The following tenders have been accepted by the Electricity Committee :—

Two 500-K.V.A. additional transformers.—Johnson & Phillips, Ltd.
One 500-K.W. additional motor-converter.—Bruce Peebles & Co., Ltd.
Cable.—B.I. & Helsby Cables, Ltd.
Copper to be made up into cables.—B.I. & Helsby Cables, Ltd.

The Education Committee has accepted the tender of Messrs. Higgins & Co., Manchester, for the electric light installation at the Old Hall Drive Municipal School.

The Tramways Committee has accepted the following tenders :—
Permanent-way special trackwork.—Hadfields, Ltd. ; Titan Trackwork Co., Ltd. ; Lorain Steel Co.
Permanent-way points, tongues and hardened-steel centres.—Edgar Allen and Co , Ltd.

**Neath.**—The U.D.C. has placed a 12-months' meter contract with the Electrical Apparatus Co., Ltd.

**Romford.**—The following tenders have been received by the Guardians for the reorganisation of the House telephone service, including the provision of new cables, instruments and batteries :—

| | |
|---|---|
| Private Telephone & Electric Co., Ltd. .. .. .. | £79 |
| General Electric Co., Ltd. .. .. .. .. .. .. | 76 |
| F. A. Greene .. .. .. .. .. .. .. .. | 90 |
| F. Hodgson & Co. .. .. .. .. .. .. .. | 92 |
| Gent & Co., Ltd. .. .. .. .. (withdrawn) | — |
| Siemens Bros. & Co., Ltd. .. .. .. .. " | — |
| Young & Marten, Ltd. .. .. .. .. .. .. | 92 |
| Turnham & Co. .. .. .. .. .. .. .. | 94 |

The lowest tender has been recommended for acceptance.

**Ship Lighting.**—A contract for the supply of "Royal Ediswan" lamps for one year has been given by the British India Steam Navigation Co. to the Edison & Swan United Electric Light Co., Ltd.

**Southampton.**—The T.C. has decided to extend the contract with the British Electric Transformer Co. for a further period of two years.

**Stalybridge.**—The Joint Board has accepted the tender of the Sturtevant Engineering Co , Ltd., for two air filters.

**York.**—The Electricity Committee recommends the acceptance of the tender of the Worthington Pump Co., Ltd., for a forced draught cooling tower, at £2,126, including the cost of foundations for a second tower when required, and the tender of the British Thomson-Houston Co., for alterations and improvements to the switchboard at the Electricity Works, at £176 10s. 6d. It also recommends the acceptance of the tender of the same company for specially designed switchgear required in connection with the charging of the electric omnibuses, at £80 per set for each of the two boosters.

## FORTHCOMING EVENTS.

**Royal Institution of Great Britain.**—Friday, February 5th. At 9 p.m. At Albemarle Street, W. Paper on "Science and Industrial Problems," by Prof. A. W. Crossley, F.R.S.

**Association of Mining Electrical Engineers (London Branch).**—Friday, February 5th. At 8 p.m. At Northampton Polytechnic Institute, St. John Street, Clerkenwell, E.C. Paper on "Protective Devices Against Lightning and Surges," by Messrs. E. K. Scott and L. F. Progarty.

**Electro-Harmonic Society.**—Monday, February 8th. At Holborn Restaurant, Ladies' Night.

**Institution of Mechanical Engineers (Graduates' Association).**—Monday, February 8th. At 8 p.m. At Storey's Gate, S.W. Annual Lecture on "History of the Metallurgy of Iron and Steel," by Sir R. A. Hadfield, F.R.S.

**Institution of Civil Engineers.**—Tuesday, February 9th. At 8 p.m. At Great George Street, S.W. Paper on "Engineering Operations for the Prevention of Malaria," by Mr. F. D. Evans.

**Association of Engineers-in-Charge.**—Wednesday, February 10th. At 7 30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Boilers and Boiler Mountings," by Mr. Vernon Smith.
Saturday, February 13th. Social and Dance.

**Institution of Automobile Engineers.**—Wednesday, February 10th. At 8 p.m. At Institution of Mechanical Engineers, Storey's Gate, S.W. Paper on "Magneto Ignition," by Mr. J. F. Henderson.

**Institution of Electrical Engineers.**—Thursday, February 11th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Conditions Affecting the Variations in Strength of Wireless Signals," by Prof. E. W. Marchant.

**(Manchester Local Section).**—Tuesday, February 9th. Liverpool visit. At 7.30 p.m. At the Laboratories of Applied Electricity, Liverpool University, Brownlow Street. Paper on "Conditions Affecting the Variations in Strength of Wireless Signals," by Prof. E. W. Marchant.

**(Scottish Local Section).**—Tuesday, February 9th. At 8 p.m. At 207, Bath Street, Glasgow. Paper on "Distribution and Rise of Temperature in Field Coils," by Prof. M. MacLean, Messrs. D. J. MacKellar and R. S. Begg.

**(Birmingham Local Section).**—Wednesday, February 10th. At 7 30 p.m. At the University, Edmund Street. Paper on "Polyphase Commutator Machines," by Mr. N. Shuttleworth.

**(Yorkshire Local Section).**—Wednesday, February 10th. At 7 p.m. At the Technical College, Bradford. Lecture on "Wireless Telegraphy," by Prof. E. W. Marchant.

**Physical Society of London.**—Friday, February 12th. At 8 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "The Criterion of Steel Suitable for Permanent Magnets," by Prof. S. P. Thompson, F.R.S. ; "A Galvanic Cell which Reverses its Polarity when Illuminated," by Mr. A. A. C. Swinton ; "An Investigation on the Photographic Effect on Recoil Atoms," by Messrs. A. B. Wood and A. I. Stevens.

**Salford Technical and Engineering Association.**—Saturday, February 13th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "How Plants Protect Themselves," by Mr. J. E. McDonald. Ladies invited.

**Greenock Electrical Society.**—Saturday, February 13th. Visit to Royal Technical College, Glasgow.

**North of England Institute of Mining and Mechanical Engineers.**—Saturday, February 13th. At 2 p.m. At Newcastle-upon-Tyne. General Meeting.

## THE E.T.U.: LONDON DISTRICT.

WE have received from Mr. J. Potter, district secretary of the Electrical Trades Union, the following report of a meeting of the London members of the Electrical Trades Union held on Saturday last, in the Chandos Hall, at which the joint report of the sub-Committees of the L.E.M.A. and the E.T.U. was adopted, together with resolutions for an advance of wages, Government intervention with regard to food prices, and a protest against the method proposed for making financial grants under the Housing Act, 1914.

Brother Rolf occupied the chair, and after a few preliminary remarks, called upon the district secretary to give the report of the Joint Board of the L.E.M.A. and the E.T.U.

Brother Potter stated that the period of six months' trial of the L.E.M.A. Working Rules having expired, the Board had drafted a report which was being placed before both Associations. In the first instance, the employers had drafted a report, which they afterwards withdrew in favour of the report presented by the delegates from the Union, to which they had made small additions. (These additions are marked by capital letters).

*January 28th*, 1915.

To the London Electrical Masters' Association.
To the Electrical Trades Union.

REPORT OF JOINT BOARD.

"1. The Joint Board appointed for the purpose of investigating, over a period of six months from July 1st, 1914, complaints in respect to the operation of the Working Rules issued by the London Electrical Masters' Association, 1914, has met on four occasions, viz. :—November 3rd, November 24th and December 17th, 1914, and January 28th, 1915.

"2. The Board has dealt with a number of complaints as to breaches of the Rules by members of the Masters' Association and non-members, comprising :—Eight breaches of Rule 1 (Disability), 12 breaches of wages, and five breaches of country money. The result of the Board's action as regards members has been generally satisfactory ; but as regards non-members, although the action taken by the Board has in some cases tended toward improved conditions, in others it has elicited no response. No complaint of a breach by the men has been received. In these circumstances the Board would recommend the Association and the Union to consider the possibility of bringing any pressure to bear in the case of unfair conditions being employed.

"3. The results of the Board's investigations show the desirability in the interest of all parties of the careful observance of the Rules both by members and non-members.

"4. The Union's representatives have on several occasions raised the question of amending certain Rules, but owing to the powers

of the Board being limited to the investigation of complaints of non-observance or cases of hardship WHERE THE RULES ARE OBSERVED, and giving interpretations of the Rules for the guidance of members, we are precluded from making any suggestions in that direction. The Board would advise that the scope of the inquiry should be extended to allow the consideration of alterations to the Rules, SHOULD SUCH ALTERATION BE THOUGHT DESIRABLE, and any recommendations be submitted to the Masters' Association and the Union.

"5. The Board recommend that a Committee similarly constituted to the present one should continue to sit and to meet every two months."

Brothers Western, Webb, and Greenwell, delegates to the Joint Board, having spoken, and a number of questions having been answered, the Report was adopted.

Brother G. Butler, South-West Branch, advocated that an application be made for an advance of wages to 11d. per hour with a 50-hour week.

Brothers Greenwell, District Committee, and C. Collins, Central Branch, moved the following resolution, which was carried :—

That an application be made to the London Electrical Masters' Association for an advance of wages to 1s. per hour, with a 48-hour week.

Brothers Stavenhagen, West Branch, and Slark, District Committee, moved the following resolution, which was carried :—

That the delegates to the Joint Board move for the deletion of the Disability Clause and all reference to pipe-fitters and improvers from the working rules.

Brothers Vaughan, District Committee, and Greenwell, District Committee, moved the following resolution, which was carried :—

That this meeting of London Electrical Workers protests against the Government's decision to loan funds to local authorities under the Housing, No. 2 Act, 1914, only when and where unemployment is acute in the building trades, and a demand be made that financial help be given irrespective of trade fluctuations.

Brothers Vaughan, District Committee, and Stavenhagen, West Branch, moved the following resolution, which was carried :—

That this meeting of London members of the Electrical Trades Union calls upon the Government to take immediate action with regard to high prices of food stuffs, coal, &c., which are pressing hardly upon those whose life is already a struggle for subsistence.

Brothers Sorace, Fleet Street Branch, and Buchan, Fulham Branch, spoke to the resolution.

Brother Kinniburgh, General Organiser, made a statement on the new rules and emphasised the necessity of strengthening the organisation.

It was decided that the report of the Joint Board and the other resolutions carried by the meeting should be communicated to the technical and general Press.

It was decided to hold another general meeting of members on Monday, March 1st, 1915.

## NOTES.

**Institution and Lecture Notes.—Wireless Society of London.**—The Presidential Address for the current session was delivered to this Society by Mr. A. A. Campbell Swinton, in the I.E.E. Lecture Hall, on January 26th, the meeting being well attended. After announcing that it was the Committee's wish that in the present crisis he should remain in office a second year, the President read a fraternal greeting from Colonel Ferrié (now on active service) who wrote that on land and sea wireless telegraphy had fulfilled all the functions expected from it in this war, and would doubtless be yet more valuable in later stages of the campaign. A suitable reply having been framed on behalf of the Society, the President announced that the Society had furnished a number of operators complying with the very stringent requirements of the Post Office, and had besides rendered other services, concerning which more could be said later. They would have to wait also to learn just what part wireless telegraphy had played in the present war. Using an excellent collection of apparatus, much of it of historical interest, Mr. Campbell Swinton demonstrated the fundamental phenomena of electromagnetic and electrostatic induction and high-frequency discharges. A single-phase electromagnet exemplified electromagnetic induction by lighting a lamp "wirelessly," by heating a metal ring held round it and by throwing off or "levitating" a ring not subjected to mechanical restraint. A three-phase magnet caused great amusement by the way in which its rotating field spun all manner of metallic objects, such as coins, rings and skeleton squirrel-cage rotors. Mr. Swinton exhibited slides to show the nature of condenser discharges, and using current of about 200,000 cycles per second frequency, he showed how a lamp could be lighted, though short-circuited by a few inches of copper wire, the latter being in an inductive loop. He also demonstrated electrostatic induction from loop to loop, and showed that sufficient current at this frequency could be passed through the body to light a 100-volt, 20-C.P. carbon lamp; at ordinary frequencies such a current would be fatal. By further raising the pressure, using Tesla's transformer, a variety of interesting discharges was obtained, and using current at 20,000 volts, an arc was struck and maintained between hot rods of soda glass (which is a conductor when heated). Finally, the Poulsen modification of Duddell's musical arc was exhibited, and it was shown that whereas a Tesla discharge was noisy and intermittent, the Duddell arc provided a quiet and continuous discharge of very much higher frequency and much more suitable for wireless telegraphy and telephony.

**Diesel Engine Users' Association.**—At the last meeting of this Association, held at the Institution of Electrical Engineers, the use of Mexican fuel oil was discussed. Letters were read from several firms or undertakings who had actually used, or were using, this particular class of fuel oil, giving their experiences in the matter. An interesting report on the influence of sulphur in liquid fuels used in internal-combustion engines was referred to, and it was arranged that this should be circulated among the members of the Association. The Admiralty specification for fuel oil was also discussed, and the Committee of the Association was requested to collect further information on the subject of specifications for this class of fuel, with a view possibly of eventually preparing a specification which could be used as a standard by the members of the Association.

Mr. Geoffrey Porter (of Worthing) had prepared some interesting notes on the subject of Diesel engine insurance, and, after a discussion on this subject, it was suggested that the insurance offices should be approached with a view of discussing with them the whole question of insurance against breakdowns, for which risks such a wide variation in rates obtains at the present time.

The next meeting is to be held on Friday, February 19th, at the Institution of Electrical Engineers. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, at 19, Cadogan Gardens, London, S.W.

At the meeting of the BIRMINGHAM LOCAL SECTION on Friday last, Prof. Andrew Gray delivered his Kelvin lecture on "Lord Kelvin's Work on Gyrostatics." There was a good attendance.

**Associazione Elettrotecnica Italiana.**—The Association has elected as its new president Signor Guido Semenza, formerly vice-president and secretary of the International Congress and of the Comitato Elettrotecnico Italiano. In a speech delivered at the yearly meeting of the Association of Working Electrical Installations on "The Present Conditions of the Market for Electrical Energy," the new president outlined the four chief openings which lie immediately before the Italian electrical industry. These are —Railway traction, agriculture, electrochemistry and electrometallurgy. Italy, in the opinion of Signor Semenza, offers a larger scope for the development of electric traction than any other country. The chief hindrance to its realisation is one of finance, which may be overcome by the electrotechnical industry directly interested, who will thus contribute to create a demand, so to speak, for their own products. One gain which will result from the introduction of electricity into agriculture will consist in the utilisation of the surplus summer and daylight production. And while the chemical and metallurgical industries cannot pay existing prices for energy, small improvements, which will inevitably be effected, will facilitate a vast absorption of electricity, and tend to a great expansion of the electrical industry in the near future. In a more comprehensive elaboration of his views in the *Elettrotecnica*, the author points out that the yearly absorption in Italy of electrical energy for motive power and lighting purposes has now reached such a degree of regularity as to preclude the possibility of rapid movements, but the utilisation of the water resources has barely begun. At the moment it is somewhat at a standstill, owing to the falling off of the demand for electrical energy. Hence there is need for seeking new outlets for existing surplus supplies, and for those new ones which may be profitably obtained in the future. The various services of agriculture offer, as previously stated, an outlet, as does railway electrification, which, in his opinion, although started, has not made a definite spring; house heating and domestic cooking present other outlets, but the latter is fettered by taxation difficulties. Additional arguments for the development of the electrochemical and electrometallurgical industries are found in the dearness of coal (mostly imported, and made still dearer by the war), while water-generated electricity can be produced at a cheap rate, and in the fact that many Italian native ores can only be economically treated by the electric system.

**National Illumination Committee of Great Britain.**—The report of the chairman was presented at a special annual meeting of the Committee on January 12th, and stated that the work done had consisted mainly in the establishment of rules and appointment of officers. The Committee has passed a resolution to the effect that it is desirable that a uniform international method be adopted for rating and marking all sources of light, with a view to the consideration of the subject at the next Session of the International Commission on Illumination. Messrs. H. G. Colman and W. Duddell have been appointed representatives of Great Britain on the Executive Committee of the Commission. The officers are as follows:—Chairman, Mr. Edward Allen; Vice-Chairmen, Messrs. W. Duddell and A. P. Trotter; secretary and treasurer, Mr. W. J. A. Butterfield, 66, Victoria Street, S.W.

**Association of Mining Electrical Engineers.**—At a meeting of the WEST OF SCOTLAND BRANCH at Glasgow, on January 23rd, a paper by Mr. Bowman, on "Electricity at the Coal Face," was read. Mr. Bowman maintained that electricity might be advantageously and economically used where the colliery was fairly large and old, with a number of steam-using auxiliaries, where the roads were long, where the seams were thin, where Special Rule 15 did not apply, and when the load factor due to pumping could be kept high. Electricity was particularly advantageous where a group of collieries could be unified under one electrification scheme. According to his own experience, electricity applied direct would generally give the most economical results, but it might be advisable in connection with coal-cutting, from the point of view of safety and reliability, to use compressed air.

**Royal Scottish Society of Arts.**—Dr. J. Erskine Murray is delivering a course of lectures to the Society on "Electric Waves and the Principles of Wireless Telegraphy and Telephony."

**Royal Institution.**—At a general meeting on February 1st the special thanks of the members were returned to Dr. H. D. Rolleston for his gift, in the name of Miss Davy (niece of Sir Humphry Davy), of a bust of Sir Humphry Davy, executed in 1822 by Samuel Joseph.

**Society of Engineers.**—The new President, Mr. Norman Scorgie, was installed and read his inaugural address on Monday last. The President's gold medal was presented to Mr. A. S. E. Ackermann, for his paper on "The Utilisation of Solar Energy."

**Institution of Electrical Engineers.**—On Thursday last week, in London, and again at the meeting of the BIRMINGHAM LOCAL SECTION on Friday, Prof. A. Gray, LL.D., F.R.S., read the Kelvin Lecture, on "Lord Kelvin's Work on Gyrostatics." The lecture was fully illustrated with experiments.

**Willesden Polytechnic Electrical Engineering Society.**—The thirteenth annual dinner is to be held on Saturday evening, February 6th, at Reggiori's Restaurant, Chapel Street, Edgware Road, at 7 p.m. The chairman is Mr. Frederic H. Taylor, A.M.Inst.E.E.

**Educational Notes.** — CITY AND GUILDS (ENGINEERING) COLLEGE, Exhibition Road, S.W.—The following special advanced courses have been arranged for the Electrical Engineering Department :—

"Design of Alternating-Current Turbo-Generators," by Prof. Miles Walker, on Wednesdays, February 10th to June 2nd, at 4-5 p.m.

"Design, Manufacture and Uses of Transformers," by Mr. A. P. M. Fleming, on Thursdays, March 4th to June 17th, at 4-5 p.m.

See also our advertisement pages to-day for further particulars.

**Rate of Pay for Armature Winders.**—The Court of Arbitration of the Board of Trade has determined that the rate of wage of the armature winders in the L.C.C. tramways department shall be increased from 10d. to 10½d. per hour as from January 1st. The Court, in making their award, desire to express their regret that, as recorded in the minutes of the meeting of the Rolling Stock Conciliation Board, held on November 26th, 1914, representatives of the men should have stated that, in the event of an increase of the rate of wages not being granted, the employés had determined to slow down to such an extent as to make the L.C.C. pay the same amount for work done, as it would pay if the present rate were increased.

**Parliamentary.**—*Standing Orders.*—All the Private Bills have now been before the Examiners for proof of compliance with Standing Orders. The consideration of several has been postponed, whilst in the case of the Halifax Corporation Bill non-compliance has been found, owing to the promoters having failed to secure the consent of the road authorities in regard to several lengths of tramways proposed outside the borough. The Bill will now go before the Standing Orders Committee, who will decide whether it shall proceed.

*South Shields Bill.*—A poll has been taken of the ratepayers in regard to the South Shields Corporation Bill, which was defeated at a town's meeting. A majority decided in favour of proceeding with the Bill.

*Doncaster Corporation Bill.*—At the town's meeting called some time ago to consider the Bill of the Corporation, Clause 129, which provides that the Corporation may, in connection with its electricity undertaking, sell, let for hire, and fix, repair and remove, but shall not manufacture, lamps, meters, electric lines, fuses, switches, lampholders, motors and other electric fittings, was defeated. The Corporation has since taken a poll, and the clause was again defeated.

**Germany's Copper Famine.**—A correspondent of the *Daily Telegraph* in Rotterdam quotes an article in the German technical journal, *Die Metallborse*, on the subject of the copper supply, as follows :—"We can get a good deal of copper from the territories of our enemies now in our occupation. Other sources of supply are kitchen utensils and the cables of electric railways and tramways, some of which are not now running, such as that between Halle and Bitterfeld. Copper can be taken also from the tramways and telephones in Belgium. The material from these sources could be used almost immediately. We have sufficient copper for quite a long time."

**Russia.**—The Consul-General for Russia (30, Bedford Square, W.C.) is willing to receive inquiries from British firms respecting a manufacturer's agent who is now in this country from Russia. The said agent already represents several British firms there, and he wishes to secure further representations for aluminium, brass, brass wire, rubber thread, electric lamps, and fittings, &c.

**Catalogues Wanted for Australia.**—A firm of merchants and agents in Sydney wants catalogues and price lists of British arc-lamp carbons, metal conduits, and electrical accessories. These should be addressed to H.M. Trade Commissioner for Australia, 81, Pitt Street, Sydney, N.S.W.

**Loaded Submarine Cables.**—The German Patent No. 210,151 (British Patent No. 5,547, 1907), "Improvements relating to electric cables containing induction coils," has been before the German Patent Court at the instance of a well-known firm of submarine cable manufacturers who demanded its revocation on the ground of anticipations, but the decision was that these were not substantiated, and the patent was upheld in all its claims.

**Fatality.**—A Cambuslang miner, who was injured while working an electric coal-cutting machine in Gilbertfield Colliery, has died in the infirmary.

**Patents and Alien Enemies.**—Messrs. H. R. Witting and Partners have been granted a licence by the Board of Trade in respect of Patent No. 9,845 of 1911, owned by Messrs. K. & Th Möller, G.m.b.H.

**Electro-Harmonic Society.**—The next concert (Ladies Night) will be held at the Holborn Restaurant (King's Hall), on Monday evening, February 8th, at 8 o'clock, Capt. H. Riall Sankey, R.E. (ret.), M.Inst.C.E., will preside. The preliminary programme is as follows :—Miss Caroline Hatchard (soprano) Miss Dorothy Webster (contralto); duettists, Miss Mabel Braine and Miss Jessie Reeve (in their delightful musical ensemble) Mr. Anderson Nicol (tenor); Mr. Heath Francis (baritone); Miss Edith Abraham (violin); Mr. Arthur Thomas (humorous entertainer); Mr. George Bolton (entertainer at the piano); solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

**A Conduit Tramway Effect.**—A correspondent, writing to the *Standard* recently, described a curious phenomenon on the Brixton Hill conduit tramway which occurred at the time of the recent snowstorm. Power had been cut off early in the afternoon, leaving the cars standing; apparently about 7 p.m current was again switched on, and a brilliant light was observed, which seemed to be travelling down the hill.

The correspondent continued :—"The most probable explanation is that the snow and slush, together with the salt thrown down on the roads, collected in the tramway conduit and made a partial connection between the live rails under the roadway, the travelling of the flashes being due to the fact that as soon as a flash occurred at any point the heat dried the water out at that point, which would cause flashing to continue at the next wet section.

"The interest in the occurrence, to an electrical mind, consists in the fact that the flashing continued for such a considerable time before the current was sufficiently great automatically to switch off the power at the supply station. This actually occurred after a few minutes, but I venture to say that the actual conditions which caused the display might not occur once in a hundred similar cases."

**Inquiries.**—The Hydro-Electric Power Commission of Ontario (engineering department), whose headquarters are at Continental Life Building, Toronto, wishes to get into touch with British firms who have developed special systems of wiring, and who carry materials for standard house wiring in stock, as it is its intention to investigate thoroughly the merits and demerits of various standardised European methods. The Commission has in mind bare concentric wiring using a single central conductor, with a bare metallic sheathing forming an outer earthed conductor, metal-sheathed wires in which two conductors are enclosed in a light, but fairly strong, metallic sheathing, and the various weights of lighter steel conduits. Its chief concern at present is to look into methods which will cheapen the cost of wiring, and so bring electricity within reach of a larger number of people.

Makers of small house service meters, for 3 to 18 16-watt lamps, are asked for.

**The Electrification of Hens.** — The rapid growth of chickens subjected to high-frequency treatment has been demonstrated in this country (see ELECTRICAL REVIEW, December 19th, 1913). Now Mr. G. C. Newell, of Chicago, a Welshman by birth, who keeps 150 hens in his back garden, states (says the *Daily Call*) that last year he obtained from them 18,000 eggs. He found that they did not lay much in winter, as they went to roost earlier and got up later, so he installed electric light in their quarters, connected with switches in the house. He says: "At six in the morning I turn on the switch, and the fowls get up, thinking it is daylight. The lights are turned off at daylight, when the neighbours' fowls are just arising. At 4.0 the lights are turned on again, and they are kept going until 9.0 at night, when I turn all out except the 2-C.P. lamps. These give just sufficient light to give the appearance of dusk, and the fowls begin going to roost. I leave the small lamps lit all night, so that if any of the fowls want to get up at night to eat they can do so.

"Eleven days after the lights were installed the daily average jumped from 26 eggs to 83. During the moulting season under the old custom, when most of the food was going to feathers instead of eggs, I had only 11 eggs a day. Now I get 52 a day during the moulting season. By my method I keep the chickens thinking they are getting the same amount of daylight all the year round, and I am keeping them thinking all the time."

This sounds very satisfactory in a way, but it looks uncommonly like sweating the poor hens. In this country it would be impracticable, owing to the vigilance of the Trade Unions.

**Municipal Authorities and Coal Supplies.** — A correspondent says that great interest is being manifested in Lancashire and Yorkshire coal trade circles in the conference to be held to-day (Friday) in Manchester, convened by the Manchester and Salford Corporations to discuss the threatened coal famine, and to secure, if possible, the suspension of the Mines Eight Hours Act. Over a score of Lancashire and Yorkshire Corporations will be represented at the conference. Inquiries made amongst miners in various parts of South and South-East Lancashire coalfields go to show that any attempt to set aside the Eight Hours Act, even temporarily, will be strongly resented by the bulk of Trade Union miners, who contend that there is no fear of a coal famine occurring for the present, at any rate. Numbers of pits, they say, work only five days per week.

**Appointments Vacant.**—Charge engineer (30s.), for St. Albans Electricity Works; switchboard attendant (27s.), for Morecambe Corporation electricity department. Particulars are given in our advertisement pages.

**Water Softening by Electrochemical Methods.**—Among the papers prepared for the meeting of the American Society of Refrigerating Engineers held recently in New York City was one by Mr. C. P. Landreth, of Philadelphia, calling attention to the fact that electricity will hasten chemical reaction and thereby improve the results obtained with boiler-feed-water softening compounds. To soften water it is analysed in the usual way and the chemical compound determined which will precipitate the scale-forming compounds present in the water. For instance, calcium hydroxide is used to remove calcium bicarbonate, sodium carbonate is employed to remove calcium sulphate, &c. After the softening compound has been added to the boiler-feed water, it is circulated past parallel electrodes which are placed close together in order that as much of the water as possible may be brought in contact with the surface of the plates. Because of its ionising property electricity will separate the compounds into their components, thereby hastening the recombination to form precipitates, which coagulate and are removed without difficulty.

Unaided by the addition of any energy, the reaction between calcium sulphate and sodium carbonate to form insoluble calcium carbonate and soluble sodium sulphate is ordinarily very slow, but if electricity be allowed to ionise the water containing these compounds the precipitate can be quickly removed. In a plant mentioned by the author of this paper, the calcium carbonate in solution was reduced to 3 grains per gallon, which is within 1/160,000 of the theoretical amount which would be held in solution, the electrolysis producing sufficient coagulation, so that the precipitate could be readily removed in filters. Ten million gallons of water per day was treated in this manner with a continuous power requirement of only 480 watts per 1,000,000 gallons. —*Electrical World.*

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

**Central Station Officials.**—The Eccles Town Council is asked to confirm the appointment of MR. H. SHORT, of Salford, as switchboard attendant, in the place of Mr. Glithero, resigned. LANCE-CORPORAL MULLINER, the assistant electrical engineer, has been offered a commission as Second Lieutenant.

The Poplar Borough Council has been recommended to grant the following increases in the salaries of members of the staff of the electricity department:—MR. F. TAIT, assistant manager, £262 10s. to £275 per annum; MR. V. H. CRUICKSHANK, station engineer, £237 10s. to £250; MR. E. R. INGRAM, mains engineer, £237 10s. to £250; MR. C. E. FARRANCE, sales manager, £225 to £237 10s.; MR. C. A. O'NEAL, assistant sales manager, £175 to £185; MR. A. H. VINCENT, junior clerk, £65 to £71 10s.; MR. P. C. G. WESTLAKE, charge engineer, £175 to £185; MR. W. E. PLOWMAN, charge engineer. £175 to £185; MR. J. FORSYTH, £162 10s. to £175; MR. C. W. COPPINGER, charge engineer, £150 to £162 10s.; MR. A. E. RICKETTS, sub-station engineer, £150 to £162 10s.

The Bermondsey Electricity Committee has received applications from the employés of the department for increases in salary, but has decided not to take any action in regard thereto, except in the case of Mr. J. W. Pendrey, mains foreman, who at present receives 60s. a week. In this case, the Committee recommends that Mr. Pendrey should be given a gratuity of £10, having regard to the extra amount of work he is called upon to perform while the mains superintendent is with the Forces.

MR. J. C. WILLIAMS, deputy borough electrical engineer and tramways manager at Rotherham, has been appointed electrical engineer to the Erith U.D.C., at a salary of £350 a year. MR. A. COVENEY, his predecessor, will continue to act until Mr. Williams arrives, at a remuneration to be fixed.

MR. EMERSON, late assistant engineer of the Galway Electric Lighting Co., has been presented with a gold watch by the staff on leaving for St. Albans.

We are informed that MR. W. A. BROWN has resigned his appointment as distributing engineer to the St. Pancras Borough Council, after over 17 years' service, to take up a position with the Pirelli-General Cable Co., of Southampton, as manager of the underground cables sales department, and that he will be located at headquarters, 144, Queen Victoria Street, E.C., after the 1st prox.

The Keighley T.C. has decided, by 15 votes to 6 to advance the salary of the borough electrical engineer, MR. H. WEBBER, from £325 to £400. Mr. Webber has a separate salary of £100 as tramways manager.

**General.**—MR. A. S. MANN has resigned his position with the L.C.C. tramways, and has accepted a position as examiner in the drawing office, on the staff of Messrs. C. A. Vandervell and Co., of Acton.

A South African contemporary states that MR. E. G. IZOD has succeeded Mr. J. H. Rider as head of the engineering staff of the Central Mining—Rand Mines group.

MR. ARTHUR J. CRIDGE has accepted a position with the British Westinghouse Electric and Manufacturing Co., Ltd. Since April, 1911, he has controlled the meter department of the Electrical Co., Ltd., but his new duties are connected with the sale of transformers. He will be at Trafford Park for some time in order to familiarise himself with the company's manufactures in this direction.

MR. FRANK DUDLEY DOCKER has been elected to a seat on the board of the Metropolitan Railway Co., rendered vacant by the retirement of the Hon. Francis McLaren, M.P., who has accepted a commission in His Majesty's Forces.

MR. JOSEPH TIERNEY, College Green, Dublin, has been elected consulting electrical engineer to University College, Dublin.

**Obituary.**—MR. T. H. WELLS.—A link of unusual interest in the telegraph world has been severed by the death of MR. THOMAS HENRY WELLS, the late secretary of the Anglo-American Telegraph Co., Ltd. He entered the Electric and International Telegraph Co. (Incorporated 1846) in 1847, and when that company was taken over by the Post Office he joined the first Atlantic Cable Co., serving successively as traffic accountant, accountant and secretary, retiring in 1912 when the Anglo-American Co. was leased to the Western Union Telegraph Co., of America. He was thus identified with American cable companies from their infancy, and was for 65 years associated with telegraphy. Such long service is, we believe, a record. The advance in telegraphy, the ups and downs of cable companies, and the fight for control of Atlantic traffic during his secretaryship of 32 years of the Anglo-American Telegraph Co., brought him into very close acquaintanceship with Jay Gould, Cyrus Field, Bennett Mackay, the Marquis of Tweedale, Sir John Pender, J. S. Morgan, and many other prominent men, who have long since passed away. His knowledge of the history and working conditions of cable companies was profound and unique. A telegraph form of 1857 reminds us of the fact that in that year there were only four offices to take messages in Manchester, and three offices in Leeds and Liverpool. No message was delivered beyond half-a-mile without porterage, and no charge was made for names and addresses of either sender or receiver. A wag who had arranged to advise his friends in London of his safe arrival in Liverpool by tendering a form containing only his name and that of the addressee, found, however, he could not announce his safe arrival in that way for nothing. In 1856 there were only 340 telegraph stations in Great Britain and Ireland. Mr. Wells initiated and organised the stores department of the Electric and International Co., travelling periodically over the whole country in the late fifties. He was an elocutionist of quite exceptional power and used his remarkable gift freely in the interest of many and various charities. Annually for a long period an evening of "Readings and Recitations" was given by him on behalf of the Post Office Orphans' Home at St. James's Hall (Large Hall), London, when he appeared appeared before crowded audiences under the name of "Herbert Walton." In 1871 at the instance of Florence Nightingale he gave an entire evening at the same hall in aid of the Distressed French Peasantry. Charles Dickens attended on several occasions, and considered Mr. Wells's powerful renderings of his works were the finest studies and presentations of the scenes and characters of his books, notably the "Death of Quilp" scene. At the time of his decease Mr. Wells was still a director of the House Property and Investment Co., and vice-chairman of the British Equitable Assurance Co. He was a man with extraordinarily good health, absence from City circles for more than a day being a rare occurrence. A very brief illness preceded his death at 81 years of age. He was a widower for 17 years, and leaves a family of two sons and three daughters.

MR. W. EDGAR ALLEN.—We regret to learn of the death, which occurred on January 28th, of Mr. William Edgar Allen, who, as long ago as 1868, founded the firm of Edgar Allen & Co., steel manufacturers, Sheffield. In 1890 he turned the business into a limited company. Mr. Allen was a man of great enterprise, and he succeeded in building up business connections in all parts of the world, his linguistic attainments and commercial training assisting him greatly in endeavours to this end. He travelled in all parts of the world in the interests of his firm, which now has an annual wage-bill of about £200,000.

MR. R. O RITCHIE —The death occurred at Tollgates, Battle, Sussex, on January 29th, of Mr. Robert Ord Ritchie, electrical engineer. Deceased, who passed away suddenly from heart failure, at the age of 57 years, had resided at Battle since 19 8. He was a brother of the late Lord Ritchie, of Dundee, was a member of the Institution of Electrical Engineers, and was associated with the construction of electric tramways at Rome, Leeds, Huddersfield, and elsewhere. At Battle he had served on the Urban Council.

## NEW COMPANIES REGISTERED.

**Electric Lamp Factors, Ltd.** (139,131).—This company was registered on January 27th, with a capital of £6,000 in £1 shares (5,000 pref.), to carry on the business of agents for, factors of and dealers in electric glow lamps or other lamps of any description, lighted by electricity, and any apparatus and appliance connected with the consumption and supply of electricity, etc. The subscribers (with one preference share each) are: M. H. Robinson, Struan, Fassett Road, Kingston-on-Thames, engineer; L. I. Robinson, 9, Staple Inn, W.C., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are M. H. Robinson and L. I. Robinson. Solicitors: Farrer, Porter & Co., 2, Wardrobe Place, Doctors Commons, E.C.

**Elieson Electric Traction Co., Ltd.** (139,120).—This company was registered on January 26th, with a capital of £1,000 in £1 shares, to acquire and turn to account any invention relating to the production, treatment, storage, application, distribution and use of electricity; to carry on business as motor car, landaulette, cab, omnibus and van proprietors, manufacturers of motors, motor vehicles, ships, boats, motor boats, launches, flying machines, submarines, etc. The subscribers (with one share each) are: C. P. Elieson, 24, St Mary Abbots Terrace, Kensington, W., electrical engineer; F. Mariaux, 66, Frith Street, Soho, W.C., director; L. E. Porel d'Angond, 28, Buer Road, Fulham, S.W., motor traction engineer. Private company. The first directors (to number not less than two or more than five) are C. P. Elieson, F. Mariaux and L. E. Porel d'Angond (life directors). Qualification, one share. Solicitors: Canwarden & Co., Gloucester Mansions, Cambridge Circus, W.C.

**Sperry Gyroscope Co., Ltd.** (139,126).—This company was registered on Jan. 26th with a capital of £2,000 in £1 shares, to carry on the business of manufacturers, importers and exporters of and dealers in gyroscopes and gyroscopical appliances and devices for steadying ships, boats, submarines, aeroplanes and all kinds of airships, mono-rail and other cars, carriages, wagons and vehicles, manufacturers of and dealers in electrical supplies, mechanical and electrical engineers, etc., and to adopt an agreement with the Sperry Gyroscope Co., of Manhattan Bridge, Plaza and Flatbush Avenue, New York City. The subscribers (with one share each) are: R. E. Gillmor, 57, Victoria Street, S.W., engineer; T. A. Morgan, 57, Victoria Street, S.W., engineer. Private company. The number of directors is not to be less than three or more than nine; the first are E. A. Sperry, R. E. Gillmor, and T. A. Morgan. Solicitors: Hasties, 65, Lincoln's Inn Fields, W.C. Secretary, H. S. Jones.

**A. Robinson & Co., Ltd.** (139,142).—This company was registered on January 28th with a capital of £15,000 in £1 shares (7,000 pref.), to take over the business of mechanical and electrical engineers, founders, smiths, manufacturers and patentees of ships' telegraphs, nautical instruments and all kinds of signalling, indicating and recording instruments and appliances carried on at 3 and 3a, Knowsley Road, Bootle, Lancs., as "A. Robinson & Co.," and to adopt an agreement with P. R. Keppie. The subscribers (with one share each) are: P. R. Keppie, 3, Knowsley Road, Bootle, Lancs., engineer; E. A. Lambert, 47, Alexandra Road, Great Crosby, Lancs., engineer. Private company. The number of directors is not to be less than two or more than five; the first are P. R. Keppie and E. A. Lambert (both permanent managing directors, with £300 and £150 per annum respectively as remuneration). Qualification, £250. Solicitor: J. W. A. North, 15, Lord Street, Liverpool.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Thomas Kesnor & Co., Ltd.**—A memorandum of satisfaction in full on December 30th, 1914, of mortgage dated December 29th, 1911, securing £250, has been filed.

**Drake & Gorham, Ltd.** (70,275).—Capital, £125,000 in £1 shares. Return dated October 22nd, 1914. All shares taken up; £85,000 paid; £40,000 considered as paid. Mortgages and charges: Nil.

**Monte Video Telephone Co., Ltd.** (27,208).—Capital, £160,000 in £1 shares (87,000 pref.). Return dated November 5th, 1914. 86,492 pref. and 72,680 ord. shares taken up. £159,172 considered as paid. Mortgages and charges: Nil.

**East India Tramways Co., Ltd.** (74,457).—Capital, £100,000 in £1 shares (15,000 pref., 35,000 ord., and 50,000 defd.). Return dated December 14th, 1914. 7,476 pref., 33,433 ord., and 50,000 defd. shares taken up. £1 per share called up on 7,476 pref. and 7 ord. shares; £7,489 paid (including £6 paid on 24 pref. shares forfeited); £83,426 considered as paid on 33,426 ord and 50,000 defd. shares. Mortgages and charges: Nil.

## CITY NOTES.

### Yorkshire (West Riding) Electric Tramways Co., Ltd.

SIR HERBERT S. LEON presided on January 22nd at the tenth ordinary general meeting, held at 31, Throgmorton Street, E.C. In proposing the adoption of the report, he said he was not in a position to say that substantial progress had been made by the undertaking during the year. Still, the results were very much better than the most sanguine shareholder had a right to expect considering the many adverse circumstances which the war had brought about, for the receipts were actually £81 in excess of the previous year. In 1912 they had what they then regarded as a boom year, and the traffics were up nearly £7,000. Up to the end of July, before the war commenced, they had beaten their previous record and were £1,264 to the good, and there seemed every likelihood of increased traffics during the remainder of the year. Then came the catastrophe of the war and they, like other tramways, suffered considerably, particularly during the earlier stages. He was, however, pleased to say that public confidence was speedily restored and their income, although varying from week to week, became on the average equal to the previous year. That was a remarkable achievement and demonstrated that the business they had made was solid and reliable and would be affected as little as any similar businesses through the war. The gross income was £74,110, which included for the first time an item of £275, Pontefract electric lighting. He stated last year that they had purchased the provisional order for lighting the town of Pontefract. They completed the installation of the necessary plant and commenced to supply in July. There had been little business since, as many of the prospective customers had deferred the wiring of their houses and business premises until more settled times. It always took some years to establish and bring to a paying basis an electric undertaking, and with that in their minds they arranged to purchase current in bulk for five years, and they hoped during that period to build up the business without incurring any serious loss of interest. The capital involved was about £12,000. It was yet too early to express any definite opinion, but he thought this would prove to be a nice paying little property yielding a satisfactory return in a few years time when things had again become normal. To return to the tramway undertaking, on a car mileage basis they had taken 10.001d. per car mile as against 9.938d. last year, an increase of 0.063d. That did not seem much, nor could it convey much to their minds, but tramways and light railways were worked on small margins, and every small increase of profit multiplied by the car mile unit meant a considerable gross sum. The tramway revenue had grown steadily but surely. In 1905 the receipts were £38,051, and the working expenses £19,963, leaving a balance of £18,088, whereas last year the receipts were £74,110 and the expenses £32,404, leaving a balance of £41,706. The working expenses last year were less by £937 than those of the previous year, which was very satisfactory seeing that they were paying higher wages and higher prices for practically everything they bought. Fuel had cost them more, but they had made a big saving of £1,096 in the upkeep of the permanent way as a result of their expenditure upon paving. From the day they commenced running the tramways they had improved them in every possible way, and to-day he thought their property was worth very much more than it was originally. They had spent considerable sums in renewals last year from the depreciation and renewals fund account in order to improve the undertaking, and not necessarily because the parts replaced were worn out. The big item in that account—£3,958—was due to the substitution of granite setts for York stone setts in Normanton and Castleford. They would have to face considerable further expenditure in a similar way where York stone was still in existence on the track. The working expenses per car mile last year were 4.373d., as against 4.476d. in the previous year, a decrease of .103d., and the percentage of expenses to receipts was 43.72 as against 45.4, a difference of 1.32 per cent. The reduction was due to the decreased cost of the maintenance of the permanent way. The balance of revenue carried forward was £41,706, and other items gave them a total of £42,061 to deal with. Debenture interest absorbed £11,406, and there was an amount of £577 interest on six per cent. bonds which appeared for the first time. It was found necessary in the course of the year to borrow £21,000, and they did so by the issue of six per cent. bearer bonds. There was no difficulty in raising the money among the stock-holders—in fact, if more had been required it could easily have been obtained without their going to the public. He might mention that 52 of their servants had joined the Forces and their places were being kept open for them when they returned, and during their absence the company was helping their dependents. After paying all expenses the balance remaining to be carried to appropriation account was £26,524, which was £787 less than the previous year owing to the payment of the bond interest. Adding £5,520 brought into the account, they had a total of £32,045 to deal with. They had paid the 6 per cent. dividend on the preference shares, which absorbed £12,808; £3,215 had been placed to the depreciation and renewals fund; £296 had been transferred to the accident reserve fund; and £5,000 to the general reserve, which left £10,725 to be carried forward. He hoped the board would not be accused of reckless finance when, for the first time, they had paid the preference dividend in full. He would like, however, to say that they would not strain the resources of the company in order to keep up the payment of that dividend if, owing to the war, there was going to be any serious decrease in the traffics. None of them could say what the immediate future had in store for them, owing to the war, and they could only hope for its speedy and victorious termination.

Mr. ERNEST REMNANT seconded the motion and the report was adopted.

### Delabole Electric Lighting and Supply Co., Ltd.

AN adjourned meeting of shareholders was held on January 18th at Delabole, Mr. M. WELLS presiding.

Mr. F. C. HAUGHTON (acting for the Secretary, his son, who is with the Colours) presented the second statutory report.

The CHAIRMAN pointed out that the report covered only six months and was quite satisfactory. An extra cable was needed as far as the head of the village, so that the consumers at Rookhead and Medrose might have better light. He was pleased to say that the work had been verified by an expert as a most satisfactory and effective installation.

Mr. HAUGHTON congratulated the shareholders on the report. No dividend was declared, it being desirable to place the company on a good financial basis. He did not consider the price too high. Of course, as a shareholder he wanted dividends; but, as a consumer, he would like the light cheap.

The CHAIRMAN, in reply to observations, said the directors were entering into certain negotiations by which capital would be raised, and with another £200 they would be able to present a clean sheet.

The report was adopted. At the instance of Mr. STACEY the Old Delabole Slate Co. were thanked for freely providing the motive power.

## Llandudno and Colwyn Bay Electric Railway, Ltd.

MR. A. W. TAIT presided on Jan. 22nd, at Basildon House, E.C., over the annual meeting. In moving the adoption of the report, he said that the profit for the year, after providing for operating and administration expenses, and interest on debenture stock, amounted to £5,144, as compared with £7,764 for 1913. The traffic receipts amounted to £15,672, a decrease of £2,039, which was entirely due to the interruption of the holiday season by the war. The outbreak of the war at the busiest period of the company's year was exceedingly unfortunate, as at the end of July, notwithstanding interruptions to the service in the earlier part of the year in consequence of doubling work, the figures showed a slight increase on those for the previous year. He was glad to state that since the close of the financial year they were able to record an increase in the earnings as compared with the same period last year, which was, to a certain extent, due to the presence of troops for training purposes in both Llandudno and Colwyn Bay. It was, of course, difficult to estimate to what extent the summer traffic of 1915 would be affected by the war, but it was reasonable to assume that it would not be so severe as that experienced last year. Miscellaneous receipts showed a slight decrease as compared with the previous year. On the debit side of the profit and loss account there was an increase of approximately £130 in the amount charged for power expenses. This was due to the fact that, in the early part of the year, track doubling operations were in progress which handicapped the working of the system to a certain extent, and, owing to the frequent stopping and starting of the cars, caused an increase in the number of units used. Other heads of expenditure showed decreases as compared with the corresponding figures last year, the decrease amounting to approximately £200 in respect of the item "general expenses." "Repairs and maintenance" would probably have also shown a decrease but for the fact that some exceptional expenditure was incurred upon maintenance of cars which had been put in thoroughly good order. The amount charged in respect of interest on debenture stock was somewhat larger this year, owing to the increased amount of stock issued to meet capital requirements. The track was doubled during the year from the end of Mostyn Avenue to St. John's Chapel, Llandudno (approximately 1¼ miles). The benefits had already been felt, and would be still more appreciated during the busy seasons of the year. The doubling of the track was now complete practically from the centre of Llandudno to the outskirts of Colwyn Bay. This had enabled the company to facilitate considerably the traffic arrangements, and it would also assist them in more effectually combatting the competition which they had to face in the shape of motor 'buses. Turning to the balance sheet, they had expended during the year approximately £18,250 on additions of a capital nature, which consisted mainly of the cost of doubling the track and of expenditure in connection with the extension to Old Colwyn. The construction of this extension was now being carried out, and would be completed in a few weeks' time. The district of Old Colwyn was growing rapidly, and there was a fairly large settled population, so they had every reason to hope that this extension would prove remunerative not only in summer, but the whole year round. Owing to the present financial position created by the war they had been unable to place the balance of the debenture stock, but arrangements had been made with the company's bankers for a loan against the security of the said stock to complete the extension. It was only intended to carry out for the present such work as was necessary to open the line for traffic. They had also decided not to order any additional rolling stock for the moment, although the requirements of the system, having regard to the added length of line, would necessitate an addition to the rolling stock to cope adequately with the summer season traffic. They had also succeeded in obtaining the consent of the Board of Trade to the use of trailer cars, which would also assist them in dealing with rush traffic in the summer season. The balance available for distribution, after providing debenture interest and sinking fund, was £4,538, which it was proposed to apply as follows:—A dividend at the rate of 4 per cent. per annum (payable less income tax), which would absorb £3,976, and to be carried forward £562. The sinking fund instalments referred to were, in their opinion, sufficient to meet the depreciation of the system, and they had, therefore, not made any charge under the heading of "depreciation." The reserve account stood at £4,000, as before. He thought the shareholders would agree that the net result for the year might be considered satisfactory, and their thanks were due to the manager and staff at Llandudno.

Mr. T. STOKER seconded the motion, which was carried.

## German Electrical Companies.

The *A.G. Carbidwerk Lechbruck*, whose carbide plant is leased to the Bosnian (Jaiee) Electricity Co., of Vienna, records net profits, after allowing for depreciation, of £3,600 for 1913-14 as contrasted with £1,900 in the preceding year. It is proposed to pay a dividend for the first time, namely 3½ per cent.

The *Suddeutsche Telephonapparate, Kabel und Drahtwerke, of Nuremberg*, whose share capital of £50,000 is held by the Felten & Guilleaume Co., report net profits of £173, after having placed £4,400 to depreciation in 1913-14 as compared with £5,300 in the preceding year. The balance has been carried forward; no profits were earned in 1912-13.

The *Bergmann Elektrizitats Unternehmungen, of Berlin*—the financial enterprise of the Bergmann Electricity Co., which decided some time ago to limit the former's activity to the conclusion of operations then on hand—reports gross profits of £15,000 for 1913-14, as compared with £6,800 in the previous year. As net profits the accounts show the sum of £9,500 as against £4,000, and the debit balance consequently becomes reduced to £27,000 on a paid-up share capital of £900,000.

The *Deutsche Sudsee Ges für Drahtlose Telegraphie, of Berlin*, which was jointly formed by the German Netherlands Telegraph Co. and the Berlin Wireless Telegraph Co. about two years ago to work a twenty years' concession for wireless telegraphy at Yap, Raboul and Apia, reports receipts of £12,000 for the year ended on June 30th, 1914. After meeting general expenses, depreciation, etc., the accounts indicate net profits of £2,800 on a share capital of £65,000. The loss incurred in the previous year has been extinguished, leaving £2,100 to be carried forward.

The gross profits of the *Wotan Werke A.G., of Leipsig*, are returned at £18,500 for 1913-14, as compared with £21,900 in the preceding year. The defrayal of general expenses and the appropriation of £1,900 for depreciation, as contrasted with £2,700 in 1912-13, leaves net profits of £8,100 as against £10,000. As a result of the war the directors state that the inland debts owing had been entered at specially low amounts, whilst the debts due from hostile countries had been entirely written off, although a large loss on them was not apprehended. The dividend recommended is at the rate of 15 per cent., this comparing with 20 per cent. in 1912-13.

The report of the *Elektro-Osmose A.G., of Berlin and Frankfort-on-Main*, which was formed in 1913 with a share capital of £150,000, states that the year 1913-14 was mainly devoted to developing the internal organisation, and the continuation of scientific experiments, which resulted in relatively high expenditure in Germany and abroad. As a consequence, the year closed with a loss of £29,000, but actual working operations are expected to begin gradually in the current financial year. The commencement of regular work at the china clay washery at Chodau, near Carlsbad, where work is to be undertaken according to the company's process, is to start next month. It has been decided to increase the share capital to £450,000.

The report for 1913-14 of the *Fabrik Isolierter Drähte (late Vogel), of Berlin*, states that the turnover in August and September experienced a considerable reduction as compared with the equivalent months in 1913 in consequence of the outbreak of the war. Including receipts from investments the gross profits amounted to £53,000, as against £52,000, and after setting aside £6,300 for depreciation, as contrasted with £7,000, and defraying general expenses, there remain net profits of £32,000 as compared with £31,000. The directors, who recommend the payment of a dividend of 13 per cent., as in 1912-13, add that the volume of business in the first three months of the new financial year shows a falling off owing to the entire cessation of the export trade.

The *Ges. für Stickstoffdunger, of Knapsack*, reports gross profits, which were realised almost entirely from manufacturing, amounting to £59,000 in the twelve months ended with June 30th, 1914, as compared with £57,000 in the previous year. After allocating £22,800 to depreciation, as against £22,600 in 1912-13, the accounts show net profits and balance forward of £25,000 as contrasted with £23,000, and a dividend of 6 per cent. is in contemplation, as compared with 8 per cent. in 1912-13. The report states that the trade was subject to great fluctuations during the year in consequence of the considerable augmentation in the inland production and exceptional deliveries of foreign artificial and natural fertilisers and the rise in the prices of raw materials and of labour. Since the close of the financial year the slightly increased stocks had been cleared, and all departments were now in full operation, although much higher working expenses had to be reckoned with during the war. On the other hand the war had opened new scope of activity for the nitrogen industry which would possibly lead to a large extension of the plant.

## Chatham and District Light Railways Co.

**THE directors' report for the half-year ended December 31st, 1914, states that the revenue was £27,503, and the expenses were £14,277, leaving £13,226; less rent of Rochester Corporation lines, £1,872; interest on debentures, £881; interest account, £525; leaving £9,949, plus £2,768 brought forward. £6,000 has been transferred to reserve for depreciation; £2,940 to preference dividend at the rate of 5 per cent. per annum; £2,650 to dividend at the rate of 5 per cent. per annum for the half-year on the ordinary share capital; £1,127 to revenue new account. The revenue shows an increase of £1,623, and the expenses an increase of £162, as compared with the revenue and expenses for the corresponding half-year of 1913. Three additional cars were purchased and put into service in August last. A large number of the employés have joined the colours since the outbreak of the war, and allowances**

are being made to the wives and dependents, involving a charge in the half-year's accounts of £390. During the half-year £4,000 debentures of the company have been purchased and redeemed.

| Half-year ended— | Miles open. | Passengers carried. | Traffic receipts. | Average fare. | Car-mileage. | No. of cars. |
|---|---|---|---|---|---|---|
| June, 1913 .. .. | 14·98 | 4,669,151 | £22,718 | 1·17d. | 540,192 | 47 |
| December, 1913 .. | 14·98 | 5,210,322 | £25 519 | 1·17d. | 567,634 | 47 |
| June, 1914 .. .. | 14·98 | 4,880,135 | £23,214 | 1·14d. | 573,248 | 47 |
| December, 1914 .. | 14·98 | 5,782,793 | £27,225 | 1·13d. | 560,519 | 50 |

## Electrical and Industrial Investment Co., Ltd.

The directors' report for the year ended December 31st, 1914, states that the revenue account shows a profit, after payment of all management expenses and interest on debenture stocks, of £13,694 plus £7,282 brought forward, making a total available of £20,976. The directors recommend the payment of the dividend for the year on the 6 per cent. cumulative preference shares amounting to £6,000, and a dividend at the rate of 6 per cent. per annum on the 7 per cent. preferred ordinary shares for the period from March 26th, 1914, to December 31st, 1914, amounting to £4,599, carrying forward £10,377. The directors have continued to act on the principle of adding to reserve the profits made on sales of investments, and of charging losses on realisation against the reserve. The balance at the credit of reserve account is £28,298. The company holds 233 investments of the total book value of £676,928. Owing to the closing of the Stock Exchanges there were no market quotations for these investments at that date. The directors will, at a later date, when the position is better defined, make a special report to the shareholders in regard to depreciation of the investments.

The following table shows the classification of the investments according to the denomination of the securities :—

| | | |
|---|---|---|
| Debentures, debenture stocks, &c. .. .. .. .. | £324,832 | 47·99 % |
| Preference shares and stocks, &c. .. .. .. .. | 176,765 | 26·11 |
| Ordinary shares and stocks, &c. .. .. .. .. | 147,685 | 21·83 |
| Government and municipal loans .. .. .. .. | 16,777 | 2·48 |
| Other loans and syndicates .. .. .. .. .. | 10,869 | 1·60 |

The following table shows the manner of distribution of the investments amongst different classes of undertakings :—

| | | |
|---|---|---|
| Electric power and traction (combined undertakings) | £183,577 | 27·12 % |
| Tramways and omnibuses .. .. .. .. .. | 161,201 | 23·81 |
| Electric lighting and power .. .. .. .. .. | 126,052 | 18·62 |
| Railways .. .. .. .. .. .. .. | 69,631 | 10·29 |
| Commercial and industrial .. .. .. .. .. | 37,417 | 5·53 |
| Government .. .. .. .. .. .. .. | 16,231 | 2·40 |
| Oil .. .. .. .. .. .. .. .. | 13 624 | 2·01 |
| Tea, coffee and rubber .. .. .. .. .. | 12 663 | 1·87 |
| Financial, land and investment .. .. .. .. | 12,183 | 1·80 |
| Iron, coal and steel .. .. .. .. .. | 11,802 | 1·74 |
| Breweries .. .. .. .. .. .. .. | 7,964 | 1·18 |
| Telegraphs and telephones .. .. .. .. .. | 5,095 | ·75 |
| Miscellaneous .. .. .. .. .. .. | 8 619 | 1·27 |
| Syndicates and Loans .. .. .. .. .. .. | 10,839 | 1·61 |

**Mexican Light and Power Co., Ltd.**—The board announces that owing to the continued unsatisfactory condition of affairs in Mexico they have to defer the payment of the half-yearly coupon due February 1st next on the 5 per cent. first mortgage gold bonds. Representations have been and are being made on behalf of the company, not only through the British Government, but also to Washington, with a view to protect the interests of those holding the company's securities.

**Barcelona Traction, Light and Power Co., Ltd.**—With reference to the decision of last November to suspend payment of the half-yearly coupon of the 5 per cent. first mortgage 50-year bonds and the intention to prepare a plan for providing the necessary funds for continuing and completing the works under construction and for the adjustment of maturing interest, Messrs. H. F. Parshall, Robert Fleming, A. E. Baker, Gilbert Johnstone, James W. Bowhill, Charles D. Seligman and E. R. Peacock have agreed to act as a Committee in the interests of the general body of bondholders to consider the financial arrangements contemplated and submit proposals.

**Buenos Aires Port and City Tramways, Ltd.**—A circular issued by the secretary states that the financial position of the company will not allow of the payment of the interest on the first mortgage debenture stock, which falls due on the 1st proximo. The directors are in consultation with a Commitee—consisting of large holders of this stock and of the first mortgage extension bonds—with a view to promulgating a scheme for the reorganisation of the debenture debt and share capital of the company.

**Dublin United Tramways Co., Ltd.**—The accounts for the year 1914 show that the amount available for division is £98,047. A dividend at the rate of 6 per cent. per annum, less income-tax, is to be paid on the preference shares for the half-year to December 31st, and a final dividend at the rate of 5 per cent. per annum, less income-tax, on the ordinary shares for the half-year, £18,000 being set aside towards renewal of permanent way, and £5,000 to reserve and renewals fund, £11,366 to be carried forward.

**Yorkshire Electric Power Co.**—The net profit for 1914, after payment of mortgage interest was £20,535, as compared with £15,401 for 1913. An interim dividend at the rate of 2 per cent. per annum was paid in July, and the directors do not recommend a further distribution, as they wish to strengthen the position of the company.

**Central Electric Supply Co., Ltd.**—The directors recommend a dividend of 5 per cent. on the ordinary shares for the year 1914, £6 being carried forward.

**South London Electric Supply Corporation, Ltd.**—The directors recommend, subject to final audit, a dividend on the ordinary shares for the year 1914 at the rate of 5 per cent. per annum, carrying forward £2,897, as against £728 in 1913.

**Smithfield Markets Electric Supply Co., Ltd.**—The directors recommend a dividend of 2 per cent. (2s. per share) for the year ended December last.

**Metropolitan District Railway Co.**—Parliament is to be asked to sanction the issue of £300,000 debenture stock.

## STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business has dropped into a jogtrot in most of the markets. Investment suffered a check by reason of the proposal to lower the minimum prices of Consols and other gilt-edged securities. It is rightly thought that, were this to come about, people would have the feeling that further reductions might be made, and accordingly investors would wait before putting money into markets. Another factor is the advent of a New South Wales loan, with its hint that there may be others to follow before long. The electrical markets are quiet, without much feature; and the most active department in the Stock Exchange, as might well be supposed, is that devoted to armament shares, of which Vickers and Armstrongs are the two favourites.

The Home Railway market cheered up on the declaration of an unexpectedly good dividend by the Lancashire and Yorkshire. The effect radiated to speculative stocks, but stopped short of those connected with the Tube lines. Nor have the latter been influenced by the important extension of the Bakerloo which is shortly to establish physical connection with the London and North Western. In ordinary times, this would have had a strengthening effect; but in days of war, it has gone for nothing.

Underground Electric ordinary touched 2 the other day, to revert later to the previous price of 1⅞. The company's 6 per cent. income bonds remain steady at 83, and a fear which was current some weeks ago as to a possible scaling-down of the interest on these bonds in respect of the past year, has been succeeded by confidence that such a step will not be necessary. As everyone knows, the London General Omnibus Company is doing splendidly, the Government paying well for the many vehicles that have gone abroad, while those at home are filled to their capacity hour after hour. The National Steam Car dispute with its men aroused the announcement that the company might wind up business and sell its omnibuses to ready customers, presumably in the provinces; if this came about, the people principally to benefit would be those who share in the profits of the L.G.O. Company.

The first of the electric lighting companies to declare its dividend is the St. James' and Pall Mall. As briefly stated here last week, the dividend for the full year is made up to 10 per cent., comparing with 12 per cent. for 1913. The present rate is the same as that paid continuously between 1906 and 1912. In the period 1897-1904, the annual dividends were 14½ per cent. The price is unchanged at 9, which compares very favourably with the average since 1907 to date. The highest "Jimmies" reached in recent years was 19½, in 1898, and they went down to 7 eleven years later.

The Smithfield Markets Electric Supply Co. has declared a dividend for the past year of 2 per cent., carrying forward £1,300. This compares with 2½ per cent. in the previous twelvemonth, and with 2 per cent. in 1912. Melbourne Electric ordinary stock was quoted ex rights to-day (Tuesday).

The changes on the week are insignificant, save for a recovery of 2 points in St. James' and Pall Mall debenture stock. Westminster preference are better at 5, though the ordinary shares further declined ½. City of London ordinary shed 5s. There remains a demand for County preference; the old and new shares, it may be remarked, are now on all fours. It is hoped that the forthcoming reports will furnish some information on the question of coal contracts. The rise in the price of coal is causing keen interest as to the price at which the companies have contracts running, and still more as to any likelihood of their suffering from shortage, as well as high prices. Parts of London were plunged into temporary darkness on the Zeppelin alarm of Monday evening, when, by the way, several thousands of special constables lost their dinners.

The L.C.C. have decided, after all, that their Electricity Bill shall not go to Parliament. It is tempting to turn round and say: "What did we tell you?"—temptation, however, which shall be sternly resisted, inasmuch as (now that the decision is arrived at) the result may be regarded as inevitable. Remains the London Electricity Supply Bill No. 2, promoted by nine out of the thirteen London companies, and having as its central idea an authority, which was the pivot of the L.C.C. Bill. We venture to predict the same fate for this second suggestion as that which has just befallen the first.

The four companies, which are not included in the No. 2 Bill, control an area many times greater than that governed by the nine undertakers; and it cannot be seriously supposed that Parliament will sanction a scheme opposed by the concerns serving not only a much larger field than the rest, but

also embracing within that field great industrial centres in London to which the supply of cheap power will be vital. So once more we are "as we were," and the shrewd observer will have little difficulty in forming his own opinion as to what is likely to be the next, and the successful, development in connection with the pressing question of London's electric supply.

Appended is our usual list of stocks and shares in the electrical markets:—

| | Mean price. July 27. | Feb. 2, 1915. | Rise or fall this week. |
|---|---|---|---|
| **HOME ELECTRICITY COMPANIES.** | | | |
| Brompton Ordinary | 9⅛ | 8⅞ | — |
| do. 7 per cent. Pref. | 8⅝ | 8⅝ | — |
| Charing Cross Ordinary | 5¼ | 4⅞ | — |
| do. do. do. 4½ Pref. | 4⅝ | 4½ | — |
| do. do. City Pref. | 4⅜ | 4 | — |
| do. 4 Deb. | 91½ | 90 | — |
| Chelsea | 4⅞ | 4⅜ | — |
| do. 4½ Deb. | 96⅜ | 92 | — |
| City of London | 16 | 14½ | — ¼ |
| do. do. 6 per cent. Pref. | 13½ | 12⅝ | — |
| do. do. 5 Deb. | 116½ | 114 | — |
| do. do. 4½ Deb. | 100½ | 98 | — |
| County of London | 12 | 11½ | — |
| do. do. 6 per cent. Pref. | 12 | 11½ | — |
| do. do. 1st Deb. | 102½ | 99 | — |
| do. do. 2nd Deb. | 100½ | 97 | — |
| Kensington Ordinary | 7⅝ | 7½ | — |
| London Electric | 1 1/16 | 1⅛ | — |
| do. do. 6 per cent. Pref. | 5 1/16 | 5 | — |
| do. do. 4 Deb. | 92½ | 90 | + ⅜ |
| Metropolitan | 3¾ | 3½ | — |
| do. 4½ per cent. Pref. | 4 1/16 | 4 | — |
| do. 4½ Deb. | 97½ | 91½ | — |
| do. 3½ Deb. | 83 | 80 | — |
| St. James' and Pall Mall | 9⅝ | 9 | — |
| do. do. do. 7 per cent. Pref. | 7 | 6½ | — |
| do. do. do. 3½ Deb. | 81½ | 82 | +2 |
| South London | 3 1/16 | 3 | — |
| South Metropolitan Pref. | 1¼ | 1⅛ | — |
| Westminster Ordinary | 8⅝ | 8½ | — ⅛ |
| do. 4½ Pref. | 5⅜ | 5 | + ⅛ |
| **HOME RAILS.** | | | |
| Central London, Ord. Assented | 83 | 78 | — 1 |
| Metropolitan | 37½ | 32 | — |
| do. District | 21⅜ | 18½ | — |
| Underground Electric Ordinary | 2⅝ | 1⅝ | — |
| do. "A" | 7/6 | 6/- | — |
| do. Income | 88 | 83 | — |
| **TELEGRAPHS AND TELEPHONES.** | | | |
| Anglo-Am. Tel. Pf. | 108½ | 106½ | +1½ |
| do. Def. | 28 | 22½ | + ¼ |
| Chile Telephone | 7⅜ | 7⅜ | — |
| Constantinople Tel. | 4½ | 3½ | — |
| Cuba Sub. Ord. | 8⅝ | 8⅝ | — |
| do. Pf. | 16⅜ | 15⅝ | — |
| Eastern Extension | 12⅜ | 12⅛ | — |
| do. 4 Deb. | 97⅜ | 94 | — |
| Eastern Tel. Ord. | 130½ | 127 | — |
| do. 3½ Pf. | 77⅜ | 74 | — |
| do. 4 Deb. | 96¼ | 93 | —2 |
| Globe Tel. and T. Ord. | 11½ | 10 | — |
| do. Pf. | 12⅞ | 11⅞ | — |
| Gt. Northern Tel. | 32⅜ | 28 | — |
| Indo-European | 59 | 55 | — |
| Marconi | 11 5/16 | 1 1/16 | — 1/16 |
| New York Tel. 4½ | 101 | 97 | — |
| Oriental Telephone Ord. | 2 5/32 | 2 | — |
| do. Pf. | 1 5/32 | 1 1/16 | — |
| Tel. Egypt Deb. | 98 | 97½ | — |
| United R. Plate Tel. | 6⅜ | 6 | — |
| do. Pf. | 5½ | 5 | — |
| West India and Pan. | 1½ | 1⅛ | — |
| Western Telegraph | 13⅜ | 13 | — |
| do. 4 Deb. | 96½ | 95½ | — |
| **FOREIGN TRAMS, &c.** | | | |
| Anglo-Arg. Trams, First Pf. | 4⅞ | 4½ | — |
| do. 2nd Pf. | 4¼ | 4 | — |
| do. 4 Deb. | 91 | 85 | — |
| do. 4½ Deb. | 98½ | 94 | — |
| do. 5 Deb. | 96 | 88 | — |
| Brazil Tractions | 66 | 56½ | —9 |
| Bombay Electric Pf. | 11⅜ | 10½ | — |
| do. 4½ Deb. | 96 | 91 | —2 |
| Mexico Trams | 70 | 40 | — |
| do. 5 per cent. Bonds | 84 | 60 | — |
| do. 6 per cent. Bonds | 76 | 50 | —5 |
| Adelaide Sup. 6 per cent. Pf. | 5½ | 5⅜ | — |
| do. 5 Deb. | 104 | 101 | — |
| **MANUFACTURING COMPANIES.** | | | |
| British Westinghouse Pref. | 1⅞ | 1 15/16 | + 1/16 |
| do. 4 Deb. | 74½ | 70 | — |
| do. 6 p lien | 102½ | 98½ | — |
| Callenders | 11⅞ | 11½ | — |
| do. 5 Pref. | 5⅛ | 4⅝ | — |
| do. 4½ Deb. | 98½ | 98 | — |
| Castner-Kellner | 2⅝ | 2½ | + ⅛ |
| Edison & Swan, £8 pd. | 3/2 | 11/6 | —6d. |
| do. do. fully paid | 1½ | 2 | — ½ |
| do. do. 4 Deb. | 59 | 60 | — |
| do. do. 2 Deb. | 63½ | 60 | — |
| Electric Construction | 1/2 | 13/6 | +2/- |
| do. do. Pf. | 1 1/16 | 1 | — |
| Gen. Elec. Pf. | 10¾ | 10 | — |
| Henleys | 15 | 13½ | — |
| do. 4½ Pref. | 5 | 5 | — |
| do. 4½ Deb. | 100½ | 97 | — |
| India-Rubber | 9 | 8½ | — |
| Telegraph Con. | 38½ | 36½ | + ½ |

The Telegraph market's principal move is an advance in both classes of Anglo-American stocks. The excellent yield afforded by these has attracted investment attention, and the preferred is now within 1¾ of the mean price at the end of July, while the deferred is only ⅛ from its July figure. Marconis eased off to 1 9-16ths. New York Telephone bonds have come in for a good deal of attention, but there is no change in the price. Americans are hard at 10s.; Canadians stick at 4s. 3d. Telegraph Constructions at 36½ are the fraction higher. Electric Constructions are good, a florin rise taking the price to 13s. 6d.; and British Westinghouse preference regained their small loss of the previous week. On the other hand, Edison and Swan of both kinds are easier.

No improvement has occurred in the Mexican group, and last week's falls in Mexico Trams have been followed up by another drop of 5 points in the 6 per cent. bonds. Brazil Tractions weakened to 56½, a decline of 2, and the Anglo-Argentine quintet remains dull.

Armament shares do little more than hold their ground, but they continue to attract much attention all over the country. The optimist's view is that, whether the war is a long one or not, Germany must be crushed, which will mean colossal profits for the armament companies for a long time to come. Some of them are working twenty-four hours a day, and work is being refused in certain cases, because of the impossibility of accepting further orders at present. Armstrongs and Vickers at their present prices yield about 6¼ per cent. on the money. The rubber market is steady, the price of the produce keeping about 2s. 2d. per lb.

## MARKET QUOTATIONS.

OWING to the war, the prices given below are, of course, more or less nominal.

### Wednesday, February 3rd.

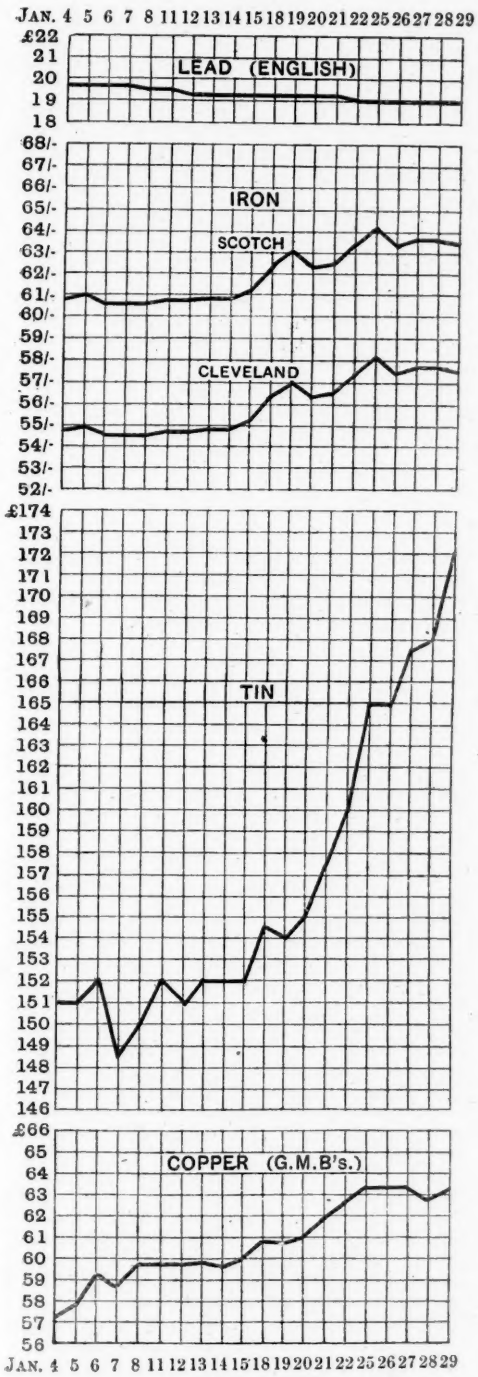
| CHEMICALS, &c. | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|
| a Acid, Hydrochloric per cwt. | 4/6 | .. |
| a " Nitric " | 19/- | .. |
| a " Oxalic per lb. | 8d. | .. |
| a " Sulphuric per cwt. | 5/- | .. |
| a Ammoniac Sal | £49 | .. |
| a Ammonia, Muriate (large crystal) per ton | £49 | .. |
| a Bleaching powder " | £8 10 | .. |
| a Bisulphide of Carbon " | .. | .. |
| a Borax " | £18 10 | .. |
| a Copper Sulphate " | £26 | .. |
| a Lead, Nitrate " | £35 | .. |
| a " White Sugar " | .. | .. |
| a " Peroxide " | .. | .. |
| a Methylated Spirit per gal. | .. | .. |
| a Potassium, Bichromate, in casks per lb. | 6d. | .. |
| a Potash, Caustic (88/90 %) per ton | .. | .. |
| a " Chlorate per lb. | 1/4 | .. |
| a " Perchlorate " | 1/- | .. |
| a Potassium, Cyanide (98/100 %) " (for mining purposes only) | Nom. | .. |
| a Shellac per cwt. | 67/- | .. |
| a Sulphate of Magnesia per ton | £5 10 | .. |
| a Sulphur, Sublimed Flowers " | £11 10 | .. |
| a " Recovered " | £8 | .. |
| a " Lump " | £8 10 | .. |
| a Soda, Caustic (white 70/72 %) " | £10 2 6 | .. |
| a " Chlorate per lb. | 8½d. | .. |
| a " Crystals per ton | 45/- | .. |
| a Sodium Bichromate, casks per lb. | 3¼d. | .. |
| **METALS, &c.** | | |
| b Aluminium Ingots, in ton lots per ton | £85 | .. |
| b " Wire, in ton lots (1 to 14 S.W.G.) " | £112 | .. |
| b " Sheet, in ton lots " | £119 | .. |
| g Babbitt's metal ingots " | £50 to £221 | .. |
| c Brass (rolled metal 2" to 12" basis) per lb. | 8⅜d. | .. |
| c " Tube (brazed) " | 10¼ | .. |
| c " " (solid drawn) " | 9⅜d. | ⅛d. inc. |
| c " Wire, basis " | 9d. | .. |
| c Copper Tubes (brazed) " | 11⅛d. | ⅛d. inc. |
| c " (solid drawn) " | 11⅛d. | ⅛d. inc. |
| g " Bars (best selected) per ton | £84 | £4 inc. |
| g " Sheet " | £84 | £4 inc. |
| g " Rod " | £84 | £4 inc. |
| d " (Electrolytic) Bars " | £68 15 | £7 5 inc. |
| d " Sheets " | £86 15 | £7 5 inc. |
| d " Rods " | £74 15 | £7 5 inc. |
| d " H.C. Wire per lb. | 9 3/16d. | ⅛d. inc. |
| f Ebonite Rod | 9/- | .. |
| f " Sheet | 2/6 | .. |
| a German Silver Wire | 1 8 | .. |
| b Gutta-percha, fine | 6/10 | .. |
| b India-rubber, Para fine | 2/6 | 1d. dec. |
| l Iron Pig (Cleveland warrants) per ton | 66/6 | 3/- inc. |
| l " Wire, galv. No. 8, P.O. qual. " | £16 | .. |
| g Lead, English Pig " | £19 5 | .. |
| m Manganin Wire No. 28 per lb. | .. | .. |
| g Mercury per bott. | Nom. | .. |
| c Mica (in original cases) small per lb. | 4d. to 2/6 | .. |
| c " " " medium " | 3/- to 5/- | .. |
| c " " " large " | 6/6 to 10/6 & up. | .. |
| o Nickel, sheet, wire, &c. " | Nom. | .. |
| p Phosphor Bronze, plain castings " | 1/1 to 1/3½ | .. |
| p " " rolled bars & rods " | 1/1½ to 1/3 | .. |
| p " " rolled strip & sheet " | 1/2½ to 1/6½ | .. |
| o Platinum per oz. | 185/- | .. |
| d Silicium Bronze Wire per lb. | 10½d. | .. |
| r Steel, Magnet, in bars per ton | £70 | .. |
| g Tin, Block (English) " | £172 to £176 | .. |
| n " Wire, Nos. 1 to 16 per lb. | 2/4 | 1d. inc. |
| p White Anti-friction Metals per ton | £44 to £194 | .. |
| k Zinc, Sh's (Vieille Montagne bnd.) " | Nom. | .. |

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

## METAL MARKET.

### Fluctuations in January.




**A Swiss Financial Enterprise in South America.**—The Columbus Company for Electrical Undertakings, which belongs to the Brown-Boveri group, was formed in 1913 for the purpose of acquiring the majority of the shares in the Compania Italo-Argentina de Electricidad, of Buenos Ayres, although its scope has been extended in the meantime to financial transactions in connection with other electrical enterprises in Argentina. According to the report for 1913-14, the company now holds over three-fourths of the capital of the Compania Italo-Argentina, and intends to advance to the latter the funds required for the extension of its supply works, for which a concession has been obtained until 1962. The company, which has also become interested in the supply companies in the towns of Dolores and Corrientes and in two companies in the city of Pergamino, earned net profits of £5,900 in 1913-14, which sum has been partly placed to reserve and partly carried forward.

## A NEW NITROGEN ELECTRIC FURNACE.

At a meeting of the Society of Chemical Industry, held on January 4th at the Northampton Institute, London, E.C., Mr. E. Kilburn Scott described and demonstrated a new furnace which he has devised for the production of nitrates from the air. The furnace is at present in the experimental stage, but it is so inherently simple in design, sound in principle, and promising as a result of the tests so far made, that there is every reason to believe it will yield results superior to those attained in any of the existing types of furnace.

*Introduction.*—The development in England of a purely English process for manufacturing nitric acid and other nitrates is a matter of national, as well as purely industrial, importance, for these materials form the basis of explosives, to say nothing of their use in agriculture and the aniline dye industry, and it is, therefore, in a high degree undesirable that we should be dependent entirely upon foreign sources for materials of so important a character. It may be objected that cheap water power, such as exists in profusion in Norway, is indispensable for the profitable development of electric furnace processes of this character. This, however, is largely a delusion, for in more than one district of England steam power can be obtained for constant loads practically as cheap as water power in Norway (the cost of which will always tend to rise on account of increasing rents), and the advantage to England is altogether secured when one considers the cost of the double freights of ammonia to Norway, and ammonium nitrate or nitric acid back again to this country. That the fixation of atmospheric nitrogen will be sooner or later undertaken in England is a certainty; the question we have to consider at the moment is, can the Kilburn Scott furnace fulfil the necessary conditions of low prime cost, small depreciation, simplicity in control, and efficiency in working, which alone will enable it to compete successfully with the types now in use in Norway and elsewhere on the Continent? From the data we have at present at our disposal, it would appear that one is justified in giving an affirmative answer to this question.

Before one can appreciate the advantages claimed by Mr. Kilburn Scott for his furnace, it will be necessary to consider briefly the salient features of the three furnaces at present in use industrially—the Birkeland-Eyde, the Schönherr-Hessberger, and the Pauling.

*Comparison of Existing Types.*—All nitrogen fixation furnaces have electrodes of metal between which alternating current arcs are formed. These arcs are "blown" into flames by a magnetic field, as in the Birkeland-Eyde, or by an air blast, as in all the other types, including the Kilburn Scott. Into the arcs or flames the air under treatment is passed, and under the great heat evolved, and perhaps, too, induced by the electronic condition of the region of the discharge, some of the nitrogen and oxygen of the air combine to form nitric oxide, which must be removed to a cooler zone as quickly as possible to prevent its dissociation back into its constituent elements. It will be unnecessary to describe here in any detail the existing types of furnaces, as descriptions of them have frequently been published, and are readily available. It will suffice to state the ideal conditions which should govern the design of a nitrogen furnace, and indicate in what manner the several types fall short of the ideal.

These conditions are:—

1. Highest possible temperature of flame (over 3,000° C.)—the higher the temperature, the greater the yield of nitric oxide.

2. To ensure a maximum supply of air to the flame and a minimum expenditure of energy in raising it to the necessary temperature.

3. To draw off and cool the fixed gas quickly.

4. To minimise adjustments and renewals of the electrodes.

5. To ensure automatic regulation of current and continuity of working.

In the Birkeland-Eyde furnace (fig. 1) the arcs, which alternate at 50 cycles a second, burn between the rounded ends of two U-shaped copper electrodes, through which water passes. A powerful electromagnet produces a direct

strong magnetic field at right angles to the electrodes. Consequently, when the alternating current flows the arcs are deflected outwards into the disc-like chamber in which they burn. As a result, a circular sheet of flame is produced. The way in which the air is brought into this flame will be clear from the figure without further explanation.

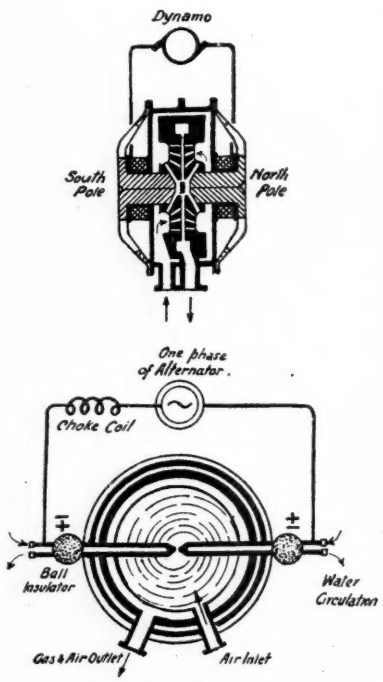



FIG. 1.—BIRKELAND-EYDE SINGLE-PHASE FURNACE.

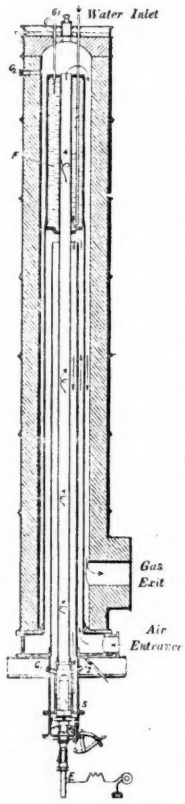



FIG. 2.—SCHÖNHERR-HESSBERGER FURNACE.

The criticisms which Mr. Kilburn Scott makes against this furnace are :—

1. The amount of energy required to energise the electromagnets (stated to be 10 per cent. of the total consumption).

2. The impossibility of preheating the air before it passes into the flame.

3. If three-phase current is available it is not possible to utilise all the three phases in a single furnace. This point will be dealt with more fully presently.

It may be mentioned that at Notodden, in Norway, there are installed 32 Birkeland-Eyde furnaces of 600 to 1,000 KW. each, and at Saaheim there are eight each of 3,500 KW. capacity.

In the Schönherr-Hessberger furnace (fig. 2) a whirling draught of air maintains a standing arc flame inside the innermost of four vertical concentric annular steel tubes, the diameters of which range from 3 ft. to 6 in. The intermediate tubes allow the incoming air to be preheated, as will be evident from a glance at the diagram. The amount of preheat is stated to be under 500° C. As compared with the Birkeland-Eyde, this furnace has the advantage of using only one kind of electric current, and the energy required for a given output of gas is, therefore, less. On the other hand, the great height of the furnaces (varying from 15 to 30 ft. at the different installations) causes considerable difficulty in maintaining the long arcs, and this, together with the long and devious air-path, presents so many mechanical and electrical difficulties, that large units cannot be built, a drawback, both from the point of view of yield and capital expenditure. Further, it would hardly be possible to run three distinct three phase arcs in one tube without their collapsing together. At Christiansand the Badische Anilin und Soda Fabrik have erected 12 furnaces, each of 450 KW., and at Saaheim there are 96, each of 1,000 KW. The largest Birkeland-Eyde units, be it noted, are of 3,500 KW.

The Pauling furnace is of the familiar horn lightning arrester type. Two electrodes diverge, leaving a fan-shaped space between them in which the arc plays. An air-blast causes the whole space to be filled with a sheet of flame. In the ordinary way the arc between such electrodes would travel upwards by the repulsion of the magnetic field, and finally snap out and break the circuit. So, for the flame to be continuous, the distance between the electrodes must be such that the normal voltage will allow a spark to jump across them and re-establish the arc at every half-cycle of the alternating current. The electrodes themselves being set several inches apart to allow the air supply to pass through, the sparking distance is diminished by fixing to the tips of the electrodes thin copper starting knives, which, of course, burn away, and are therefore gradually fed forward to preserve the arc. It will be gathered that the furnace is exceedingly simple compared with the two previous types, but the adjustable electrodes are a source of weakness. Mr. Scott is of opinion, and the same view is expressed in a Report published by the Department of Commerce and Labour of

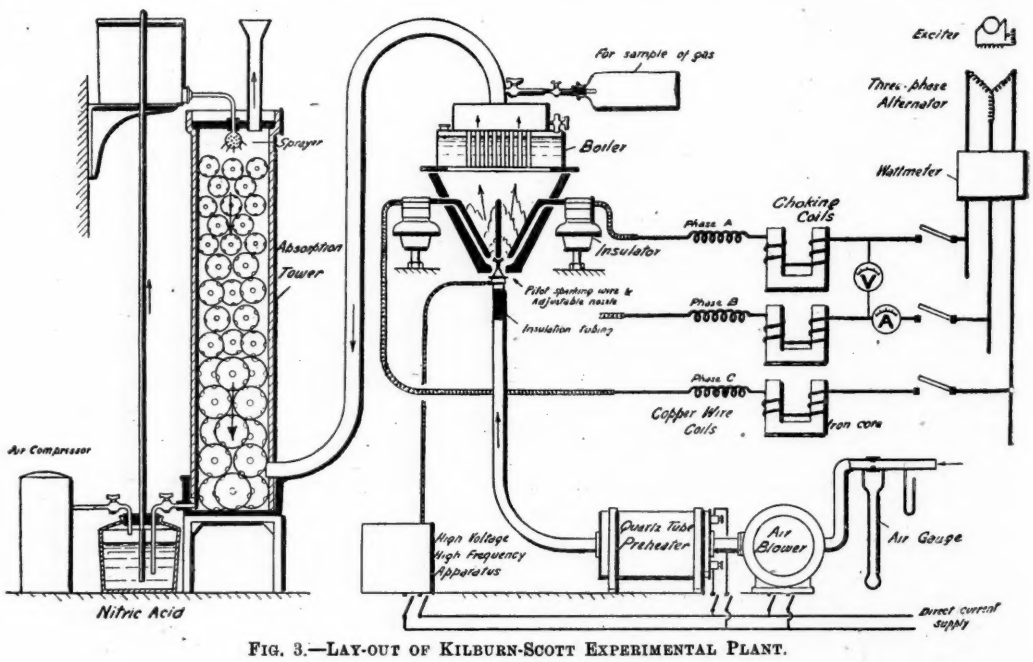



FIG. 3.—LAY-OUT OF KILBURN-SCOTT EXPERIMENTAL PLANT.

the United States, that of the three furnaces at present in use, the Pauling is certainly likely to prove the most successful. All the furnaces, however, share the defect that they are unable to operate with three-phase current in one furnace, and it is this defect which Mr. Kilburn Scott set himself to remedy.

*Three-Phase Working.*—The advantage of three-phase working is twofold. In the first place, the general use of

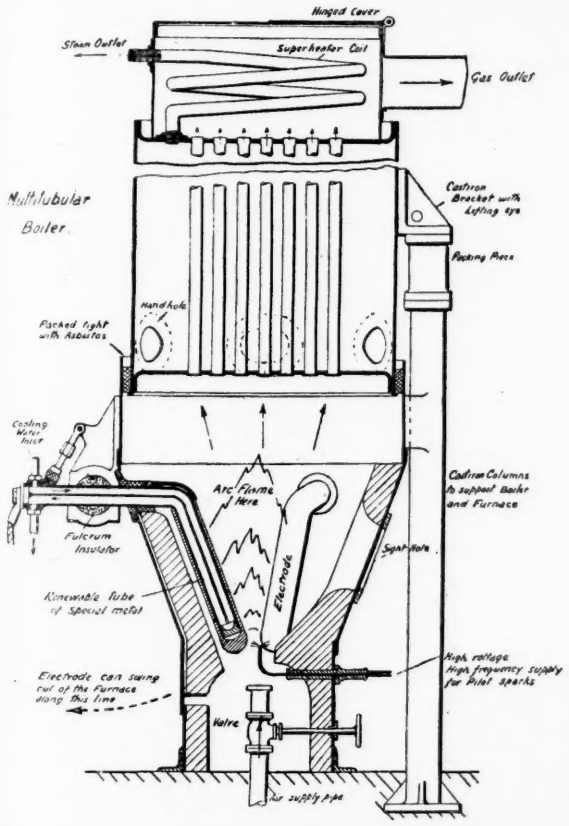



Fig. 4.—Sectional Elevation; Kilburn-Scott Three-phase Furnace.

three-phase systems renders it almost a necessity in the case of a furnace that is going to purchase from an existing centre its supply of electrical energy. Perhaps an even greater advantage than this is the higher temperature that Mr. Kilburn Scott has shown to be obtainable in a triple flame compounded of three separate alternating current arcs. This, as already stated, may mean a considerable increase in the yield of fixed gas per unit of electrical energy absorbed, and, provided only the thing is feasible and practical, this advantage should secure for a three-phase furnace an undoubted superiority over its rivals. It was predicted, not unnaturally, that a three-phase furnace would not balance well, would consume its electrodes unequally, and so forth. Experiment has convinced Mr. Kilburn Scott that none of these faults appear in practice, and certainly the little three-phase experimental furnace which can be seen working at the Northampton Institute operates as evenly and as steadily as can be desired.

*The Kilburn Scott Furnace.*—A sectional elevation of the small experimental furnace appears black in the centre of fig. 3. In general principle the furnace follows the Pauling type, except that there are three electrodes instead of two, and the starting device is simpler than the auxiliary electrodes of the Pauling furnace. In the small furnace,

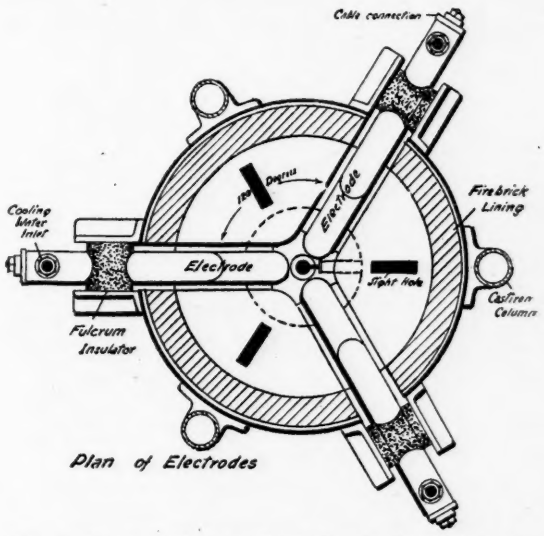



Fig. 5.—Plan of Kilburn-Scott Three-phase Furnace.

which was shown working at the meeting, the electrodes made of ½-in. steel rod bent as shown in fig. 3, pass through holes drilled in a fireclay crucible which forms the furnace-chamber, and through the bottom of which the air under treatment is blown, after being preheated in a small electric tube furnace. Three-phase current at 2,000 watts, 25 periods, is applied to these electrodes, in series with each of which is a set of choking coils—necessary for steady working. When the current is flowing, and the air is blown through, the whole crucible is filled with a mass of roaring blue flame. The starting device will be described immediately.

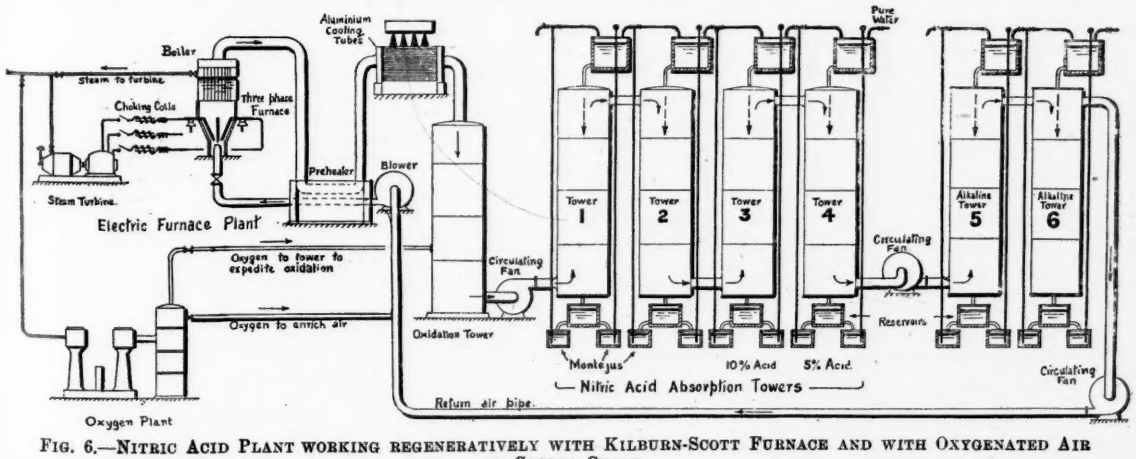



Fig. 6.—Nitric Acid Plant working regeneratively with Kilburn-Scott Furnace and with Oxygenated Air on Closed Cycle.

Figs. 4 and 5 illustrate the furnace as it would be constructed in practice. The electrodes here consist of steel tube divided longitudinally into two parts so that the cooling water travels up one side and down the other. A renewable tube of cast steel encases the electrodes; these, as they burn away, can easily be turned round, and finally renewed.

In the Pauling furnace new sections of tube have to be fitted in, a much more lengthy and troublesome procedure. The way in which the electrodes are fixed and insulated is sufficiently well indicated in fig. 4. The arcs are started by a high-voltage high-frequency spark which is emitted from the pilot sparking conductor (to earth through the electrodes), shown in close proximity to the bottom of the right electrode in fig. 4. These high-tension sparks continuously break down the air dielectric, and so maintain the three-phase main current. It is interesting to note that the two electrical circuits do not in any way interfere with one another. The necessity for the pilot spark enables the main current to be entirely put on or cut off by means of an ordinary tumbler switch which controls the primary sparking current. The ingenious method of maintaining the main arcs here described is a characteristic feature of Mr. Kilburn Scott's furnace, and unless any unforeseen difficulty should prevent its working on a large scale, it should prove a greatly superior method to the auxiliary copper electrodes used in the Pauling furnace. As the pilot conductor passes through a porcelain insulator into the furnace below the electrodes, where it is comparatively cool, there seems no reason to anticipate any special difficulties.

Another striking, and, indeed, a very bold feature of this furnace is the multitubular boiler placed immediately above the flames, as shown in figs. 3 and 4. The boiler, in fact, actually forms the roof of the furnace. The purpose of the boiler is, of course, to cool the gases as soon as possible and as quickly as possible after they leave the zone of reaction. Experience with the experimental furnace convinces Mr. Kilburn Scott that no difficulties will arise with the boiler in an industrial furnace. The nitric gases that play upon it will not yet be in the peroxide state, and one gathers that nitric oxide, even at a high temperature, will not attack iron. It will be necessary, or at least desirable, to employ in the boiler pure feed-water, and this, combined with the rapid circulation brought about by the very high temperature, is likely to minimise the formation of scale.

The steam raised in the boiler is to be used to generate electrical energy, as shown in fig. 6, so that the combination will be regenerative. Naturally, not the whole of the electrical energy required can be raised in this way! (The diagram is somewhat misleading in this respect.) As a matter of fact, the regenerative value of the steam so raised is likely to be some 15 per cent.

In fig. 6 are also indicated other regenerative features of the process; namely, the oxygenation of the air supply to the furnace, the cyclical working of the process, as far as the air supply is concerned, so as not to waste oxygen, and the way in which the preheating of the air entering the furnace is effected. With regard to the oxygenation of the air, this would best be brought about by linking up the nitric acid works with processes in which oxygen is a by-product, such as the manufacture of hydrogen for air-craft or for the hydrogenation of oils, or the manufacture of calcium cyanamide. These, however, are chemical aspects of the process, and, moreover, they are not peculiar to any particular type of furnace, so they need not be enlarged upon here. The same remarks apply to the working up of the nitric oxide into marketable products. In fig. 5 a series of towers are shown indicating the general form of the plant if it is desired to make nitric acid, the most useful and valuable of the nitrogen products. From this ammonium nitrate is easily made by direct contact with ammonia. At present it appears that ammonia is actually shipped to Norway for this purpose, and the ammonium nitrate brought back again here for the explosive manufacturer or the farmer. This strange state of affairs is a cogent argument for the establishment of nitric acid manufacture in this country on a scale commensurate with our needs. There is no valid reason on the electrical side, even if the prime source be not water power (it probably could be), why the electrical process should not work as successfully here as it does in Norway or elsewhere on the Continent, and if Mr. Kilburn Scott's claims for the increased yield of his three-phase furnace are realised on a large scale, and on the face of it there seems no reason why they should not be, his process will help greatly the development of a home industry of quite national importance.

## THE TELEPHONE IN SURGERY.

A good deal of interest has lately been aroused in medical circles by a new development in the application of the telephone to surgery. It is more than 30 years since Graham Bell suggested, *apropos* of the attempts which had been made to locate the bullet in the body of President Garfield by means of the induction balance, that a simpler method would have been—he was speaking some months after the death of the President—to use a telephone, attaching to one terminal a fine needle, and to the other a plate of metal of the same nature. The plate would then be placed on the limb to be examined, and the needle thrust in where the bullet was believed to be. On its making contact a galvanic battery would be formed within the body, which would cause a click to be heard in the telephone, and would guide the surgeon to the position of the foreign body.

This device was employed by Dr. (now Sir) James Mackenzie Davidson in Aberdeen to locate a bullet in the head of a patient, and was afterwards used in a limited way during the South African war. Until recently, however, the condition laid down by Graham Bell, namely, that the instruments used for exploration must be of the same metal as the plate placed on the patient's skin, was thought to be essential to the success of the method.

In a communication made to the Medical Society of London on January 25th, Sir James Mackenzie Davidson stated that he had now discovered that this was not at all the case, and that the telephone attachment could be used with any metallic instrument at the surgeon's command. Finding that the dissimilarity of the metals did not impair the value of the result, he tried several pairs in order to discover which would give the most distinctive sound. The embedded metals for which the surgeon had usually to search were lead, nickel, copper, iron, and some of the iron alloys used in shell manufacture, while the surgeon's instruments were usually steel, silver, or nickel-plated. With any of these instruments attached to one terminal of the telephone, he found that on contact with any of the above-mentioned metals, the loudest sound was elicited when a plate of carbon, such as was used in an ordinary bichromate cell, was attached to the other terminal. The currents generated were, naturally, small and of low pressure, and it was necessary to reduce the resistance of the body by using as large a plate of carbon as possible, and to increase the conductivity of the skin by moistening it with salt solution. He found that a cheap telephone of 60 ohms resistance, costing only a few shillings, detected these small currents better and gave a louder sound than the more expensive high-resistance telephones used in wireless telegraphy.

Sir James demonstrated his method of procedure, which consisted in the use of a telephone with double receivers for attachment to the surgeon's head, one terminal of the telephone being brought to the carbon plate, and the other to a disinfected silver wire which was bound round or clipped on to the knife, probe, needle, forceps, or whatever instrument the surgeon might wish to use. The instrument, on first contact with a bullet, gave rise to an unmistakable click on the telephone, and, when a rubbing contact was made, to a distinct microphonic rattle, and under this guidance the embedded metal could be extracted.

The lecturer added that he had found no special advantage result from the introduction of a battery into the circuit. One modification which might be employed, in the case of a surgeon whose hearing was not acute, was to pass the current, not through the telephone, but through a suitably wound galvanometer, when the movement of the galvanometer needle would indicate contact with the metal, or the arrangement could work as a relay, and a bell could be made to ring every time the bullet was touched by the surgeon's implement.

Sir James, whose demonstration obviously impressed his fellow surgeons, prophesied that a time would come when no surgeon would attempt to remove a deeply embedded metallic body without having this telephone attachment at hand.

# THE SHAPE OF THE PRESSURE WAVE IN ELECTRICAL MACHINERY.

Part I, by S. P. SMITH, D.Sc., A.M.I.E.E., and R. S. H. BOULDING, B.Sc. Part II, by S. P. SMITH, D.Sc.

(*Abstract of paper read before the* Institution of Electrical Engineers, *January 14th*, 1915.)

In Part I the electromotive force induced in windings is determined analytically, and the effect of flux-swinging is investigated. The importance of the winding factor is emphasised. Experimental confirmation is given wherever possible. (No attention must be paid to the relative magnitudes and phase displacements of the oscillograms here reproduced.)

In Part II an attempt is made to amplify and illustrate the analytical results obtained in Part I, by means of the vector diagram and by examples. Also the advantages of using the vector diagram of the fundamental for studying the circuits in a double-layer commutator winding are shown, and simple rules for obtaining the positions of the various phase tappings and connections are given.

One of the greatest advances that have been made in the development of electromagnetic machinery during the present century is the approach in the shape of the pressure wave to the ideal sine curve. Several reasons have combined to bring about this result. Thus the wide extension of the three-phase system with star-connected generators has removed from the interlinked or line pressure the third harmonic, which is sometimes considerable in the phase

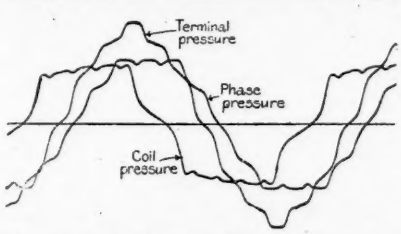



Fig. 1.—Oscillograms Showing Spacing Ripple in Phase and Terminal Pressures of Three-Phase Salient-Pole Alternator, Having Six Semi-Closed Slots per Pole.

pressure. Again, the adoption of the non-salient-pole construction for the rotors of turbo-alternators has made it possible to obtain a flux distribution which remains nearly sinusoidal under all conditions of load. Finally, the designer has also learnt what refinements are necessary in order that the pressure curve may be free from ripples.

Although there are cases where the shape of the pressure wave is not important, there is no doubt that the pure sine curve is best for general alternating-current working. Thus, the troubles occasioned by earthing the neutral, which is now common practice in central-station working, are mainly due to the existence of a third harmonic in the phase pressure. Cases arise also in the parallel working of synchronous machines where the interchange of wattless currents due to the higher harmonics becomes excessive. As an instance, a case may be cited of a six-phase rotary converter working direct off a six-wire, three-phase generator,

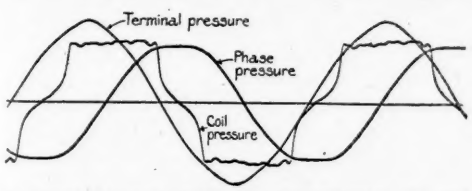



Fig. 2.—Oscillograms Showing Suppression of Spacing Ripple—due to Fractional Number of Slots per Pole—from Phase and Terminal Pressures of Three-Phase Salient-Pole Alternator. Opened Wave Winding—108 Slots (Semi-Closed); 16 Poles; 6·75 Slots per Pole.

where, owing to the harmonics, the current taken when the converter was running light was equal to the normal full-load current.

Numerous other factors of varying importance, such as low losses and high power factor in the system, safety in high-tension working, freedom from disturbances to telephones, and from resonance, &c., all demand an absence of harmonics. Also, when a four-wire, three-phase system is used for a lighting supply, the use of a pure sine wave results in the ratio, phase pressure to star pressure, being constant.

The sine curve is the most natural standard, and it is generally attainable, which would not be the case with other wave shapes. Also, the majority of our simple calculations and vector diagrams are only possible on the assumption that the quantities in question vary sinusoidally.

In Sec. 1, under the head of "Classification of Windings," the authors show that where the number of slots per pole is an integer, and a normal arrangement of slots and poles is adopted, the effect of the teeth on the wave form will be greatest (fig. 1). When the poles or slots are skewed in such a manner as to make the conductors occupy all possible positions in the field, the winding is equivalent to a uniformly distributed winding, and the effect of the teeth is *nil*. When the pole-shoes are displaced, or the number of slots per pole is fractional, the equivalent distribution of the winding is increased (fig. 2).

In all cases where there is an abnormal arrangement of the field or armature system, or a fractional number of slots per pole, it is allowable in practice to regard the winding as uniformly distributed.

In Sec. 2, a general expression for the electromotive force induced in a coil is obtained. When a coil moves relatively to the flux, an electromotive force of motion or rotation is said to be induced in it, whilst if the flux itself varies, an electromotive force of pulsation is induced. With continuous-current excitation the flux is steady, except in so far as pulsations are set up by the teeth or by armature reaction. It is here assumed throughout that the machine is unloaded. It is shown that the curve of electromotive force induced in each side of a coil is identical in shape with that of the flux distribution, but the two pressures are only in phase when the coil spans a full pitch. The coil-span factor can

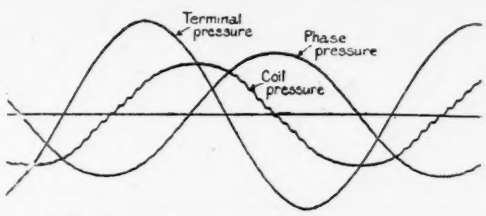



Fig. 3.—Oscillograms showing Effect of Rotor Teeth of Non-Salient-Pole Turbo-Alternator, 24 Stator Slots, nearly closed; 40 Rotor Slots closed with Cast-Iron Wedges, 16/20 Wound; 2 Poles. Rotor Slotted uniformly over whole Periphery.

effectively suppress certain harmonics in the induced pressure. For instance, if the coil spans two-thirds of a pole-pitch, the third harmonic disappears.

In Sec. 3, the electromotive force induced in a circuit of a winding by rotation in a steady field is investigated in detail, and tables of distribution and reduction factors for various windings are given.

Incidentally it is shown that there can never be a third harmonic in the line pressure of a star-connected three-phase generator, nor in the alternating pressure of a three-phase rotary converter, nor in the phase pressure when each phase extends over two-thirds of the pole-pitch, nor in the pressure of a single-phase alternator with two-thirds of the periphery wound. This also holds when the winding is placed in slots instead of being uniformly distributed. In a similar way, when the spread of winding equals two-fifths or four-fifths, no harmonic which is a multiple of 5 can appear in the pressure curve.

The effects of the slots in the rotor and stator are considered, and it is shown that when the numbers of slots per pole-pair on the stator and rotor are equal, or only differ by two, a very pronounced ripple of a high order may appear in the pressure (fig. 5)

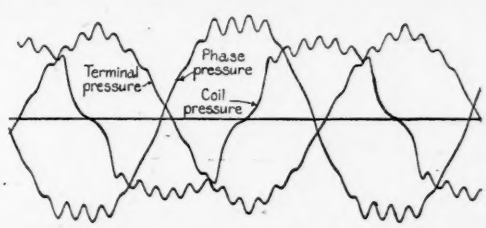



Fig. 4—Oscillograms showing Tooth Ripple due to Flux Swinging in Three-phase Salient-pole Alternator with a Whole Number of Slots per Pole. Open Slots.

The spacing ripple in salient-pole machines is chiefly important with two or three slots per pole and per phase, and unless one of the several methods for making the winding factor very small is used, it is generally advisable when a smooth pressure wave is needed, to round off the pole tips so as to reduce the harmonics. With non-salient-pole machines, the number of stator slots per pole is generally larger, and the chief care must be taken to avoid clashing with the number of teeth on the rotor.

The effect of flux pulsations due to teeth is dealt with in Sec. 4. Since most of the flux is carried by the teeth and very little by the slots, there is always a tendency for it to move as the teeth enter and leave the pole-arc. When the magnetic path in the gap has a constant reluctance but variable position, the flux will swing to and fro; when the reluctance varies, the flux will change in amount. It is probable that both these movements take place to some extent in all slotted armatures, though the former is alone of importance, as a rule.

Unless the whole magnetic circuit is well laminated the change in the flux can never be very large, since there will always be a tendency for oscillations in the magnitude of the flux to be

damped out by eddy currents and currents induced in the exciting winding. Both experience and experiment confirm this view.

The E.M.F. ripple due to swinging of total flux is of much greater importance, since with laminated shoes there is comparatively little hindrance to the flux swinging. In the worst case the magnitude of this swing would equal the flux of one tooth, and from oscillograms it is often found to exceed one-half of this amount (fig. 4). The larger the number of teeth per pole the smaller the possible swing.

The amount of flux swinging depends largely on the constructional details of the machine, such as the number of slots per pole, the ratio of slot-opening to gap, the skewing of the slots or pole-

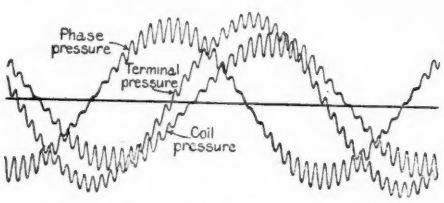



Fig. 5.—Oscillograms showing Combined Effect of Tooth Ripple and Spacing of Rotor Slots in Three-phase Non-Salient-pole Turbo-Alternator. Stator: 36 Semi-closed Slots; Rotor: 34 Semi-closed Slots with Brass Wedges, 14/17 Wound; Two Poles. Rotor Slotted uniformly over Whole Periphery.

shoes, &c., and by suitable design it can be made fairly small. The commonest method for reducing the swing is to use nearly closed slots.

Fig. 5 shows the effect of an unsatisfactory choice of numbers of slots. In fig. 6, instead of only having the required number of slots, namely, 144, there were 150. The machine had open slots. As we should expect, the pressure induced in a conductor reveals a fairly strong tooth ripple, thus proving that the flux was swinging. In the coil pressure, the ripple is already reduced, owing to the fact that the electromotive forces are not identical in phase; whilst the phase and terminal pressures are quite smooth.

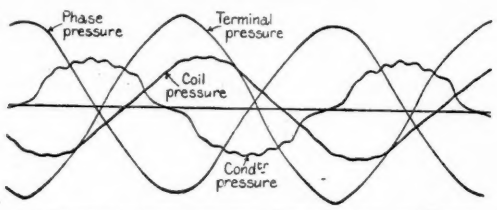



Fig. 6.—Oscillograms showing Suppression of Tooth and Spacing Ripples from Phase and Terminal Pressure of Three-phase Salient-pole Alternator with a Fractional Number of Slots per Pole. 150 Slots (open); 16 Poles; 9·375 Slots per Pole.

There are external methods of suppressing the tooth ripple from the terminal pressure. For example, a method that has found favour of late years has been the use of a resonance circuit across the terminals of the machine, adjusted to resound with the frequency of the tooth ripple; though in most cases the addition of one or two extra slots would certainly be a much cheaper and an effective way of preventing disturbances in telephones.

Regarding the effects due to the slots and teeth, it is obvious that in general it is possible to build machines nowadays in which all such effects are eliminated from the pressure wave.

## Discussion in London.

Dr. S. P. Thompson said the paper formed a brief account of the state of affairs, as known and added to by the authors, at the present time. No doubt many of the things mentioned had been touched upon by previous investigators; but the authors had succeeded better than any before in investigating the effect of ripples, and it would be as well to provide some adjective to distinguish between ripples due to stator and rotor slots. Amongst other things, the authors had given them a new definition of "circuit" which it would be difficult to apply generally. The authors enumerated the advantages of the pure sine wave, but also reminded them that they should have the flux form a pure sine curve, as then there would be no need for devices to correct it. The non-salient form of pole properly wound was better for flux distribution, and was better from the mechanical point of view. He thought it would be advantageous to simplify the mathematics for those who would make practical use of the paper in the future, and as it stopped short of certain matters, perhaps the authors would follow it up.

Mr. Burge said, with the exception of turbo-alternators, pole slots could not be slanted, as they were usually laminated. He wished the authors had not set aside the question of wave form on load; he mentioned this in regard to the proposal to use alternators with poor regulation instead of reactances.

Mr. C. C. Hawkins said the authors had not mentioned the use of the mid-coil arrangement for suppressing certain harmonics; it was not right to be satisfied when the harmonics were reduced to very small proportions, as they might give rise to very serious effects. The authors were rather uncertain on certain matters regarding flux swinging; he thought it was agreed that with fringing the conditions were reversed. He thought it was necessary to have the whole circle of polar fringe in order to make reliable deductions as to swinging.

Mr. A. R. Everest said the salient-pole rotor could be made to give just as good an approach to the sine wave as the drum type. He thought it was obviously impossible to adopt irregular slotting or spacing of coils on a large scale for manufacturing reasons; a fractional number of slots per pole was a good method. He believed the American Institute allowed as a standard any harmonic not to exceed 10 per cent. of the main wave, but a newer standard was proposed.

Dr. Howe emphasised his belief in the correctness of fig. 19 in the paper (in regard to which it may be mentioned that an alternative unsymmetrical figure had been discarded as being doubtful). It ought to be quite clear whether reference was made to ripples or to the harmonics into which they were divided.

Mr. Jakeman did not think it practicable to use an extra slot as suggested, except for single-phase machines, and taking all points into consideration he thought higher harmonics might still be present if extra slots were used.

The Authors, in replying, said the effect of load was now being considered. Dr. Smith explained that they were not advocating anything in particular, and were investigating everything that came along. He had not yet arrived at a conclusion as to the correctness or otherwise of the unsymmetrical edition of fig. 19.

## Discussion at Manchester.

Prof. Miles Walker said the authors were to be congratulated upon having given a solution of what had always been regarded by designers as a very troublesome problem. Present-day engineers had found from experience the desirability of keeping down the ripple in the E.M.F. wave as much as possible. Some engineers even inserted a clause in the specifications regarding the percentage ripple allowable, and this might be 1 per cent. or over. The main difficulty with the designer had been to predetermine the amount of ripple; it was a comparatively simple matter to take the E.M.F. of a single conductor in a machine and so determine the field form, but it was quite another matter to deduce from the field form the final E.M.F. wave form. This was the problem the authors had solved. The tables given enabled the designer to predetermine without any trouble the value of any harmonic in the final E.M.F. wave form. It was to be hoped that the authors would pursue their investigations and give the results of full-load working in addition to the no-load results recorded in the present paper. The paper was an admirable case of applied mathematics producing tables of real commercial value.

Mr. K. M. Faye-Hansen, speaking from the point of view of an alternator designer, said that most of the conclusions were known to the specialist designer, but they had never been brought forward in such a clear manner and arranged so that the result of higher harmonics could be easily predetermined. The employment of fractional windings was a useful expedient and gave excellent results, but sometimes there were economical reasons against it, the chief of which was the use of parallel connections.

Prof. Field said that the extent to which a slight ripple might be of great practical importance was illustrated by the fact that purchasers' specifications usually limited the no-load value, whereas the value of vital importance was the full-load operation; it was very hard to specify that, because it was necessary also to specify the nature of the load. In the case of a machine which it was required to delta-connect, it was of great importance to investigate the matter in advance and see that the third or seventh harmonic would permit delta-connection without serious circulating currents. Unless special precautions were taken, serious trouble might arise from the ninth harmonic. In the case of the New York Edison Co. and several other stations in the U.S.A. the original operating voltage was 6,600, but the plant was arranged for ultimate conversion to 11,000 volts; in consequence the large generators were arranged to be delta-connected. In most cases the turbo-alternator had been wound with a two-thirds coil pitch, which completely eliminated the third and ninth harmonics. He took exception to the authors' statement to the effect that on alternator work a full-pitch winding was usually employed. In the States it was more common than otherwise to have a chorded winding on alternators, particularly turbos. In order to illustrate the comparatively big effect of a very small harmonic, he cited the case of a machine with the winding chorded not quite two-thirds, but two-thirds plus or minus one slot. The effect would be almost completely to wipe out the third harmonic, the only effective amount being due to the discrepancy of one slot. The value of the third harmonic might have been considered too small to be of any account, but the ultimate burning-out of windings in slots where the coils crossed was found to be due to this circulating third harmonic current together with the extra losses due to high frequency.

Dr. G. W. Worrall, in a written communication, said that his general impression was that the authors had not sufficiently considered the individual ripple E.M.F.'s generated; the ripples in the conductor might be considerable, although the wave of terminal pressure was quite smooth. When several conductors were connected in parallel, the ripple E.M.F.'s sometimes produced circulating currents which caused unequal local heating of the machine. The ripples also caused vibration of the teeth, and serious breakdowns were by no means uncommon, which were without doubt due to this cause. There must, of course, be a certain amount of looseness in the stampings to allow the vibration to take place, but

such looseness might not be due to defective manufacture in the first instance. During the past few months two machines broke down in this way, one, a slow-speed alternator, after a few weeks' running, and the other a high-speed turbo-alternator after eight years' running. It was, therefore, of the utmost importance to suppress the ripples as far as possible in each conductor, and not merely cancel them out in the aggregate.

Mr. R. S. H. Boulding, in reply, said the only way to get rid of ripples was to avoid swinging, which could be approximately carried out by the method mentioned in the paper. Whilst the paper was confined to no-load effects, the same method applied to full-load considerations, and the results were to be regarded as qualitative rather than quantitative.

Dr. Smith, in reply to Mr. Faye-Hansen, said considerable difficulty was experienced with the shops in regard to cutting extra slots. No doubt it was a commercial question. The question of parallel circuits was very important; in the case of a two-pole machine it was practically hopeless, but with a four-pole machine two extra slots across a diameter were easily added. Generally speaking, it did not cost as much to have two extra slots as to chamfer the pole-pieces. Prof. Field mentioned the case of machines which did not have identical circuits; the whole paper went to show that identical circuits were necessary. Unsymmetrical windings were not to be advocated, and there was no reason for departing from this excellent rule.

## ELECTRIC HEATING AND COOKING.

At the last meeting of the "Point Five" Association, held in London on January 15th, Mr. Hefford, of Leeds, was elected a member.

Mr. Harold Gray, of Accrington (the Chairman), an abstract of whose remarks we give, said that in many undertakings there are other users of equal or greater importance than those in the domestic field. A suitable domestic tariff has been formed and established, and it is time that the efforts of the Association were concentrated on reclaiming another field, the trading class of property covering shops, hotels, etc. The enormous variation in the rateable value of this class of property depending on its position is a serious drawback to the elaboration of a rateable tariff.

A rate based on a sliding scale of percentages on rateable value and a fixed price per unit worked out as the result of combined experience, is a tariff which could be utilised advantageously and with profit to all concerned. The higher rated premises would have a lower percentage charge on the rateable value than the smaller ones. The general lines of the tariff being arrived at, it could be pigeonholed until an opportune time arrived to put it into force in a particular district. There are now a number of big shops which use artificial light in their interiors for all the working hours of the day and for many months in the year, for which where a flat rate of charge is in force gas illumination is employed. This would at once be rectified if a tariff on the above lines were in force.

The writer communicated with leading manufacturers asking them to state how their sale of apparatus compared in "Point Five" undertakings and others; the replies without exception indicated that for a given size of undertaking the demand for appliances is considerably in excess of that in flat rate districts. This explains why Association members are given favourable buying terms and why the suggestions of its members for improvement or alteration in apparatus are at once put in hand and often made their standard selling line.

On the subject of apparatus, if the result of sales is an index, the hot bar fire is rapidly superseding the lamp radiator as a heating medium except in special cases. There is the advantage in the former that toasting and grilling in a "Dutch" oven, etc., can be effected and the renewal of sections is cheap.

While on the question of heating, mention might be made of a somewhat interesting experiment carried out a few weeks ago. The congregation in a church suffered on Sundays from a severe down draft, and the electrical department were asked to put the matter right. It was handled as follows:—A ring of hot bar strips covered with expanded metal with occasional gaps was run round the nave of the church at a height of 21 ft. from the floor and 15 ft. from the top of the main aisle. The total loading of the heaters was 20 kw., the switching arrangements being such that either 10 or 20 kw. could be applied. This circuit is turned on first thing in the morning with the ventilators in a definite position to create an upward current, and thus get rid of the humid atmosphere in the building, and the writer is assured that the trouble has now been cured. A development of this application would produce quite a useful Sunday morning load.

The type of vacuum cleaner most suitable in a particular class of house still appears to be an open question. For big houses the use of a central permanent installation with pipes run to various points and flexible hose pipes and appliances coupled from these points is probably the only entirely satisfactory arrangement. The machine of the carpet sweeper type in which the motor is wheeled along is convenient in use in that it has no flexible hose-pipe to handle, but it is not very handy for cleaning under low furniture. This type almost invariably collects the dust in a bag, and it is noticeable that in some cases the exhausted air is not as pure as one could desire. The other type in use is that in which the cleaning apparatus is carried to a convenient stationary position and flexible hose-pipes and attachments worked from the machine in this position. This type has the advantage that cleaning can be done effectually under very low furniture and on walls, etc., without much trouble, but the heavy flexible hose-pipe is rather awkward to manipulate.

As regards electric cookers, a thoroughly reliable article can be obtained at a reasonable price provided all elaborations are excluded. A cooker built on similar lines to a gas cooker, of cast-iron, having removable fittings, with hot plate and grill on the top of the oven and without circuit indicators, thermometer and inspection window, etc., appears to give satisfaction in the majority of cases (*i.e.*, its operation is better than a gas cooker) and perhaps generalising, the simpler the machine the less trouble it will give in the long run.

For better class work where the customer will pay an increased price, useful elaborations are much valued; thus there appears a tendency where there is room to have the griller and boiling rings removed from the oven and put on one side. The oven can, of course, in this case be raised to a more convenient height. Indicating lights to show which circuit is in use are also useful and a thermometer, once its value is tested, is invaluable. There does not appear to the writer any valid reason why the simpler class of cooker mentioned above could not now practically be standardised in order that quantities could be manufactured in big batches and the selling cost reduced.

The standardising of hot plates might present difficulties; it is probable that the radiant heat (red hot) plate will be ultimately the most satisfactory type. Rapid operation can never be effected if the heating element has to heat up an iron plate as a preliminary to the heat being passed on to the cooking vessel.

The question of the pressure of supply to heavy current consuming devices is now becoming important. Should a consumer put a balanced load on the distributor (*i.e.*, on the outers of a D.C. network or three-phase on an A.C. network) or should he have an ordinary lighting service? Simplicity certainly dictates the latter course, and in thickly supplied areas consumers demands can be fairly well balanced, but in our district, in one or two isolated cases we have adopted the former course to avoid objectionable effects on the local lighting.

It is interesting to find that in the Accrington district more appliances have been connected to the system during the last three months than in any preceding quarter of the history of the undertaking.

### Discussion.

Mr. Pickvance, who opened the discussion, said the objects of the Association were, according to the Articles, simply to foster the consumption of electrical energy for domestic purposes. Without any reconstruction of rateable value tariffs, but simply by means of an active business propaganda amongst the shopkeepers, the Chairman could, no doubt, have a higher percentage of shop lighting consumers than he possessed at present. Shop lighting did not need the aid of a special body of engineers for its development. A plain flat rate, with a reduction according to quantity consumed, should meet with a favourable reception, especially if followed up by a proper system of business development. He disliked the differential percentage charge; any variation of the fixed charge, according to the size of the rateable value, seemed to be a most unorthodox way of applying the rateable value system. Although strongly in favour of this tariff for domestic purposes, he did not see how it could be applied to shop lighting and business premises generally. They would certainly have trouble with the different classes of consumers. As regarded that class of consumer who used artificial light during the daytime, this was met in Wrexham by a very simple tariff which provided that the amount used beyond a certain number of units per 8 c.p. or 30-watt lamp, per quarter, should be charged at a reduced figure, less than half the amount of the ordinary flat rate. It worked remarkably well as regarded hotels and large shops, and was automatic in this application, particularly as regarded those few shopkeepers who used the electric light principally for window lighting and had gas at the rear of their premises.

Mr. Allen did not see how the rateable value system could be applied to shops, but thought the objects of the Association were quite sufficiently definite, and that it had an enormous field in front of it in domestic supplies and appliances, and that it was unnecessary to widen the scope of the Association to take in other classes of supply. In his opinion it was better to tackle one thing and do it thoroughly. He had carried out some useful experiments with nichrome No. 2 wire, and mentioned that after maintaining a coil of wire at red heat for two months in oxygen no sign of oxidisation could be seen. He did not believe that the present time was a suitable one to attempt standardising cookers, as the development was so rapid and might turn along totally different lines to the present.

Mr. Barham considered that for new domestic supplies a two-rate system was all that was required. He emphasised the drawback to the industry of the want of hiring powers.

Mr. Grogan also considered that it was impossible to apply the rateable value system to shops, and advocated a sliding scale method of applying the rateable value system to residences in some districts. Mr. Grogan made some useful remarks on the heat distribution in ovens, and gave a description of a large electric restaurant in Derby at a cinema palace. He gave the working details of the restaurant, and added the information that the proprietors were entirely satisfied witlf the result.

Mr. Shaw (Ilford) considered that a suitable tariff for shops was the well-known maximum demand system, which he had found quite satisfactory, the rateable value system not being applicable. He also pointed out that it was impossible to push heating and cooking apparatus, even with a low tariff, if the electric supply authority was not in a position to hire out the apparatus. He found that amongst his consumers the hot-bar type of heater was far and away the most popular.

Mr. Roles (Bradford) found that in his district the demand for lamp radiators had dwindled to practically nothing. As regards the hot-bar type of heaters, the trouble had been to get them from the makers, not to sell them. Mr. Roles referred to the fact that in Bradford many consumers were utilising hot-bar heaters for other purposes than heating rooms, namely, for making toast and for warming in connection with the preparation of food.

Mr. Nevill (Wakefield), one of the most recent "Point Fives," gave some interesting figures showing the great increase in his business since the Point Five tariff was instituted for heating and cooking. He also referred to the considerable increase in the use of electricity for heating shops; and mentioned that his peak load had not been affected by the increase in heating and cooking. It was the same amount in kw. that it had been for over ten years. He also mentioned that he had been inquiring for a long time for a manufacturer who could provide a satisfactory equipment for heating the type plate of a box side branding machine. Suggestions had been made on one or two occasions, but not of a nature likely to prove satisfactory.

Mr. Cooke (Luton) urged the flat ½d. for all heating and cooking without any annual charge, and gave interesting figures from his own district in support of his contention that this was a paying business proposition.

Mr. Beauchamp (West Ham) referred with appreciation to the Chairman's method of preventing down draughts in public buildings, which he had also found to be successful and economical. He also drew attention to the use of electric heating stoves which consisted of a combination of radiant and convecting elements, pointing out that by the use of either or both features the maximum economy and comfort in heating rooms could be obtained. Referring to Mr. Cooke's remarks on heating in shops, Mr. Beauchamp drew attention to the fact that shop-heating in general could not be expected to have the same high diversity as domestic-heating, and whilst, like domestic-heating, it was to a great extent winter business, yet a large proportion of it might be expected to come on across the winter peak, a consideration the importance of which would, of course, vary with the undertaking supplying energy.

Mr. Tapper (Stepney) gave his experience that the maximum demand system met the requirements of nearly every class of consumer. One explanation was that, owing to his consumers being chiefly long hour users, they obtained low average rates. If he made any change in his tariff for domestic purposes to meet the cooking and heating business he should carefully consider, first of all, the two-rate meter system.

Mr. Long (Norwich) hoped to qualify before long for membership of the "Point Fives," and was seriously considering the adoption of this tariff. The point he was most concerned about was whether it was safe to give a flat rate of ½d. for radiators used in shops without any addition to the fixed charge. He was satisfied that this could be done in the case of private houses as the diversity factor was very great, and comparatively few would be on at the peak, but in shops one would expect the majority to be in use then. He was interested to know from several speakers that in their experience the use of radiators in shops was, as a rule, reduced in the afternoon before the peak load. In Norwich the fixed charge for shops and business premises was based on the estimated maximum demand for lighting.

Mr. Shaw (Worcester) was very busy converting lamp heaters to hot-bar, which could be remodelled at a very small cost, thus converting them from obsolete appliances to quite up-to-date ones. Speaking on the life of cookers, he mentioned that some flour mills in Worcester had a cooker for baking and testing bread, which they had had in continual use for nearly 20 years. It was made by a Chelmsford firm.

Mr. Shaw stated that if an electric soldering iron, with cheap renewable elements, for industrial purposes could be put on the market, which would be satisfactory, and which he could recommend to his consumers, there would be a use for 900 to 1,000 in one canister factory alone.

The Hon. Secretary agreed that the domestic field provided a sufficiently large one for all the energies of the Association. All undertakings have a residential area as well as a business area, and, therefore, all stations had an interest in developing domestic supplies. Besides, electric power was well catered for already; it was almost standard and was extremely easily catered for, both as regards apparatus and tariffs. For premises other than residential he thought the Hopkinson tariff with an annual charge plus a small secondary rate per unit met all the requirements, and he could not agree with the Chairman that shop lighting, hotels, etc., was a more difficult class to handle than the residential business. He was rather surprised no members had referred to the new method of heating rooms by thermostatic control. The effect of this would be largely to reduce the current consumption and put electric heating within the reach of many who could not afford it at present. He gave an example of a large thermostatically controlled electric hot water system which had been installed at Oxford Circus convenience for wash basins. The cost at present was slightly lower than for gas, and he could see his way to reducing the cost still further by at least 20 per cent. He mentioned a block of flats being erected in his district that were being cabled for heating, cooking and lighting by the builders. Electrically-heated hot water was also being installed, and the estimated consumption per annum of this block of flats was one million units, or 2,500 units per head of population. One was accustomed to looking to a block of flats of this size for 50 or 60 thousand units per annum as a maximum, and this example alone showed the enormous field still untouched for domestic supplies.

## BREAKDOWNS IN COLLIERY ELECTRICAL PLANT.

By LLEWELLYN FOSTER.

(*Abstract of paper read before the* Association of Mining Electrical Engineers (Lancashire Branch)).

Generally speaking, breakdowns of mining electrical plant may be divided into three classes:—(1) Those caused by lack of proper attention and care, including want of systematic periodical opening out of the machines for inspection, cleaning and general overhaul. (2) Those due to the machines being quite unsuitable for their work and situation. In mining work particularly, open or protected-type machines are often used when they meet the requirements of the Regulations, whereas, on account of the surrounding dust and dampness, the enclosed type should have been used. (3) Those due to faulty design, defective material and workmanship.

It is very seldom that we find any system of periodically taking machines apart for overhaul; if the windings were kept clean and varnished occasionally, a number of breakdowns would be prevented. At one colliery in the north of England there are seven Hopkinson coal-cutters in use, and the machines are only allowed to work in the pit for three weeks continuously. After that period each machine is brought to the bank to be overhauled.

One of the most frequent sources of trouble in electrical plant in mines is due to the fact that a machine is left running as a single-phase owing to one of the three fuses having melted, or possibly to there being a defective circuit on one of the three phases. Fuses that are large enough for the starting current of a squirrel-cage motor are usually too large to be any real protection when the motor is running. It would seem, therefore, that having two sets of fuses and switching over from "starting" to "running" fuses would be a simple solution of this difficulty.

A considerable proportion of breakdowns occur in the commutating parts of continuous-current machines, viz., commutators, brush-gear, etc., and sparking at these parts does not receive the careful attention it requires.

Fractured conductors, fractured commutator spokes, and flats on commutator bars are mostly due to vibration, and through consequent chafing and pounding of the insulating material "earth" faults are caused.

Regular measurements of the radial air gap should be taken and recorded, as well as the test of lifting the shaft in its bearings. Any movement in the bush or of the bush in its housing should be carefully observed. When the machine cannot be stopped, the condition of the bearing can be fairly well ascertained by inserting a pencil or rule in the oil well and letting it rest on the shaft, when any slackness will be noted by a movement of the pencil apart from the bearing housing or casting. The lighter the load the more positive will be the movement.

The switch blades and contacts of the stator circuit, and the fuse fittings and contacts require regular and systematic examination. All ends of cables, connections, etc., should be soldered to prevent the danger of the machine running on incomplete phases. When installing an "in-bye" motor, means should be provided for access to all parts of it. Some pits are naturally very wet, and breakdowns frequently occur through dampness percolating into the windings of the motors and to the starting gear. This causes "earthing" of the winding, and the trouble generally occurs at the end of the slots in the armature or rotor core. The percentage of breakdowns due to this cause would be considerably reduced by making properly constructed motor rooms, with the foundations laid out in such a manner that when the motor was installed on its bed it would be, say, 6in. or 8in. above the floor level.

Breakdowns on underground plant are frequently due to bad foundations, etc., which set up excessive vibration. Many armature breakdowns are due to mechanical defects in the driven machinery.

On some colliery plants where originally protected-type motors were installed, these have been converted into totally-enclosed machines, but without any reduction of the load. The reduced rating of a motor when totally enclosed is often lost sight of by the manager, who is usually responsible for having the motor made totally enclosed.

In the earlier days of electrical work in collieries, a bed built up of rolled-steel joists was fairly frequently met with, but the cast-iron box bed has quite superseded it. In cases where the rolled-steel joist beds are still in use it is important that they should be securely held down and well grouted in. There should be a holding-down bolt close up to each side of each bearing pedestal and each stator foot. The greatest vigilance should be exercised to prevent any of the bolts connecting the frame together from slackening back. Care should also be taken that the steady pins go right through the flange of the joist, and these steady pins should be frequently examined.

Machine-cast steel wheels should always be used for the first reduction from the motor, and should have their pitch circles marked so that they can be properly meshed. The use of "machine-moulded gearing" for such work as this is not likely to prove economical.

A 100-H.P. three-phase motor drove a haulage through gearing. The rotor and stator came into contact, and one coil in the stator was "earthed." The radial air gap was regularly measured twice a week by the colliery electrician; apparently it had not appreciably varied for many months, and on the day before the failure the gap was 0.03 in. at the smallest part. On investigation it was discovered that the motor had its greatest load when the pinion was running towards the spur wheel, thus tending to wear the top halves of the bushes. It is obvious, therefore, that a rotor may be perfectly central whilst at rest but not necessarily so when running. The makers should so design their end covers that the radial air gap can be watched whilst the machine is at work. The writer strongly recommends two "inspection doors" in the back end cover for every type and size of A.C. and D.C. motor, as this would very considerably aid in clean-special care and attention.

## TRADING AND INDUSTRIAL METHODS IN GERMANY.

BELOW are given some extracts from a report on the trade of Germany by Sir Francis Oppenheimer, H.M. Commercial Attaché in Germany, which has recently been issued by the Government. The report itself may be obtained from Wyman and Sons (Cd. 7620-14, price 5½d.)

*The Growth of Syndicates.*—Germans, in every stage of society, are prone to combination; in Germany there is hardly a branch of manufacture or of trade, however special, which has not its own organisation and probably its own journal. Manufacturers all over the Empire, producing the same goods, are brought into touch either personally or in print. The conditions of the whole home market are thus disclosed; its chances are weighed and scrutinised. The more a works specialises (and the tendency owing no doubt to the very keen home competition is all towards specialisation) the more must it co-operate with, and the more has it to rely upon, other branches of manufacture; their trade conditions have to be watched in turn. The specialist is brought into contact with the outside world. News from abroad is published and carried into distant workshops. The profusion of trade and professional papers can be gauged from their catalogue numbering 300 closely printed pages. That no branch is forgotten may be gathered from the fact that there figures among them a fortnightly magazine dealing with the interests of the foremen of platelaying gangs on the Prussian State railways (founded in 1906)! The keen competition among trade papers has produced a high standard. Much ingenuity and care is spent upon the reports of the industrial weather, with the result that no man need be taken unawares by a change of the tide.

Above all, it is the syndicates that exercise a steadying influence. This side of syndication has repeatedly been explained. Syndicates control production and sales, and, when the home market is satisfied, help towards directing merchandise abroad. In an atmosphere of industrial depression syndicates are seen to their greatest advantage—at least by their members. It is then not surprising that in 1913, and to a greater extent in the early months of 1914, syndication—the renewal of old syndicates and the foundation of new ones—should have been one of the most frequent subjects discussed in the commercial Press.

There is no doubt that after each successive boom the desire for syndication is strengthened and, at the same time, its accomplishment is rendered more difficult. The desire is strengthened because every boom gives the members of the various industries a chance of extending their works and raising their capacity of output—which means an increased production and, in consequence, an increased competition during a slump. In the first quarter of 1914 prices of unsyndicated goods reached what seemed to be the lowest possbile limit. Yet the cry for syndication became louder as the depression progressed.

The difficulties of syndication are augmented because every boom gives a further advantage to the giant works which have virtually concentrated the various stages of manufacture under one roof. They have little interest in the various syndicates controlling the respective stages of manufacture unless they are granted preponderant figures of participation, more especially in the final stages. As the smaller works, whether syndicated or not, are greatly at the mercy of these giants, they naturally prefer a state of syndication which guarantees their existence, checks competition, secures steady prices in the home market, and provides export bounties for foreign orders. For the giant concerns, syndication means financial sacrifices; but these sacrifices are expected of them as they are the princes of industry, the pillars of Germany's economic life. Their concerns have become world concerns. They embrace so many branches of manufacture, they command so many markets, that they reach above local industrial tides. The rise of such works, although it has been greatly assisted by the modern developments of German banking, is chiefly due to the application of science to manufacture. These leaders have increased their profits by carrying the science of by-products to its utmost limits, and they have thus very materially reduced their cost of production. They are generous and indefatigable where scientific research is concerned. A succession of booms has made these mammoth concerns financially independent.

*Their Influence at Home.*—The financial power to which they have attained is used for, amongst other objects, the acquisition of their own means of transport. The reason is that all the world over the item of transport is gaining an additional importance in the faculty of competition. Some powerful mining-shipping combinations are an example of this development.

The most recent development in the matter of concentration is perhaps the most interesting of all. To guarantee a steady sale of their vast output some of the big works began to effect a financial combination with their own consumers, thus following on an extensive scale an example set by the electrical industry. An important works, manufacturing machines for use on railways, has bought up a company letting out railway machinery; the firm of Krupp has bought up two shipbuilding yards; a leading factory producing electrical appliances and machinery has obtained control of an electrical power supply company.

These gigantic concerns exercise a steadying influence upon the country's economic life because their interests are world interests. Whatever the industrial tide may be at home, they are vast employers of labour; in many communities they are the backbone of local finance; together they contribute colossal revenues to the public funds. It is not unnatural, then, that such concerns obtain facilities from the Government which would be denied to the smaller fry. These privileges in turn strengthen their position and give them an additional lead. They obtain the aid of the diplomatic and consular service and the financial support of the banks, so much craved by our manufacturers.

*Effect on Export Trade.*—The necessities of the German export trade have always enjoyed the special goodwill of the authorities. Under special export railway tariffs, practically all consignments below 5,000 kilos, and most consignments above, are carried to the coast or to the frontiers at reduced rates if intended for export. In some cases the rate is as low as 1.5 pfennig (¼d.) per ton-kilom. As under the terms of these through tariffs the German export must be carried in the ships of certain German lines, they constitute, in addition to the indirect export bounties, also indirect shipping subsidies. Early in 1914 a new postal convention was signed between the German and Swiss authorities, granting additional facilities to the German-Swiss and German-Italian parcel post service; it will also indirectly benefit German consignments in post office parcels to Spain, South America, and the Dutch Indies.

The German exporter has gained considerable advantage from the German shipping companies, who appear willing to initiate services with little prospect of profit in the immediate future. This policy accounts for the increasing proportion of trade directed to such smaller countries as Chile, Colombia, Siam, Morocco, the Philippines, Venezuela, Bolivia, Uruguay, etc. The North-German Lloyd was rumoured to be about to start a direct line from Germany to New Zealand. Again, manufacturers, merchants and shippers, interested in the same markets, have clubbed together to form special societies for nursing these markets so as to be able to lay their respective wishes with greater weight before the Imperial Government. Early in 1914, all these German foreign societies formed a union among themselves. The leading firms in certain German industries (metallurgical, electrical, chemical, construction) have become world institutions, with branches established, as separate companies, in many foreign parts; as witness the German-capitalised electrical concerns in Russia and in South America, where the D.U.E.G. is probably, with the exception of the Bagdad railway, the largest German foreign enterprise. From a mercantile point of view, there can be little doubt that so far the benefit which Germany has derived from

In the Pauling furnace new sections of tube have to be fitted in, a much more lengthy and troublesome procedure. The way in which the electrodes are fixed and insulated is sufficiently well indicated in fig. 4. The arcs are started by a high-voltage high-frequency spark which is emitted from the pilot sparking conductor (to earth through the electrodes), shown in close proximity to the bottom of the right electrode in fig. 4. These high-tension sparks continuously break down the air dielectric, and so maintain the three-phase main current. It is interesting to note that the two electrical circuits do not in any way interfere with one another. The necessity for the pilot spark enables the main current to be entirely put on or cut off by means of an ordinary tumbler switch which controls the primary sparking current. The ingenious method of maintaining the main arcs here described is a characteristic feature of Mr. Kilburn Scott's furnace, and unless any unforeseen difficulty should prevent its working on a large scale, it should prove a greatly superior method to the auxiliary copper electrodes used in the Pauling furnace. As the pilot conductor passes through a porcelain insulator into the furnace below the electrodes, where it is comparatively cool, there seems no reason to anticipate any special difficulties.

Another striking, and, indeed, a very bold feature of this furnace is the multitubular boiler placed immediately above the flames, as shown in figs. 3 and 4. The boiler, in fact, actually forms the roof of the furnace. The purpose of the boiler is, of course, to cool the gases as soon as possible and as quickly as possible after they leave the zone of reaction. Experience with the experimental furnace convinces Mr. Kilburn Scott that no difficulties will arise with the boiler in an industrial furnace. The nitric gases that play upon it will not yet be in the peroxide state, and one gathers that nitric oxide, even at a high temperature, will not attack iron. It will be necessary, or at least desirable, to employ in the boiler pure feed-water, and this, combined with the rapid circulation brought about by the very high temperature, is likely to minimise the formation of scale.

The steam raised in the boiler is to be used to generate electrical energy, as shown in fig. 6, so that the combination will be regenerative. Naturally, not the whole of the electrical energy required can be raised in this way! (The diagram is somewhat misleading in this respect.) As a matter of fact, the regenerative value of the steam so raised is likely to be some 15 per cent.

In fig. 6 are also indicated other regenerative features of the process; namely, the oxygenation of the air supply to the furnace, the cyclical working of the process, as far as the air supply is concerned, so as not to waste oxygen, and the way in which the preheating of the air entering the furnace is effected. With regard to the oxygenation of the air, this would best be brought about by linking up the nitric acid works with processes in which oxygen is a by-product, such as the manufacture of hydrogen for air-craft or for the hydrogenation of oils, or the manufacture of calcium cyanamide. These, however, are chemical aspects of the process, and, moreover, they are not peculiar to any particular type of furnace, so they need not be enlarged upon here. The same remarks apply to the working up of the nitric oxide into marketable products. In fig. 5 a series of towers are shown indicating the general form of the plant if it is desired to make nitric acid, the most useful and valuable of the nitrogen products. From this ammonium nitrate is easily made by direct contact with ammonia. At present it appears that ammonia is actually shipped to Norway for this purpose, and the ammonium nitrate brought back again here for the explosive manufacturer or the farmer. This strange state of affairs is a cogent argument for the establishment of nitric acid manufacture in this country on a scale commensurate with our needs. There is no valid reason on the electrical side, even if the prime source be not water power (it probably could be), why the electrical process should not work as successfully here as it does in Norway or elsewhere on the Continent, and if Mr. Kilburn Scott's claims for the increased yield of his three-phase furnace are realised on a large scale, and on the face of it there seems no reason why they should not be, his process will help greatly the development of a home industry of quite national importance.

## THE TELEPHONE IN SURGERY.

A good deal of interest has lately been aroused in medical circles by a new development in the application of the telephone to surgery. It is more than 30 years since Graham Bell suggested, *apropos* of the attempts which had been made to locate the bullet in the body of President Garfield by means of the induction balance, that a simpler method would have been—he was speaking some months after the death of the President—to use a telephone, attaching to one terminal a fine needle, and to the other a plate of metal of the same nature. The plate would then be placed on the limb to be examined, and the needle thrust in where the bullet was believed to be. On its making contact a galvanic battery would be formed within the body, which would cause a click to be heard in the telephone, and would guide the surgeon to the position of the foreign body.

This device was employed by Dr. (now Sir) James Mackenzie Davidson in Aberdeen to locate a bullet in the head of a patient, and was afterwards used in a limited way during the South African war. Until recently, however, the condition laid down by Graham Bell, namely, that the instruments used for exploration must be of the same metal as the plate placed on the patient's skin, was thought to be essential to the success of the method.

In a communication made to the Medical Society of London on January 25th, Sir James Mackenzie Davidson stated that he had now discovered that this was not at all the case, and that the telephone attachment could be used with any metallic instrument at the surgeon's command. Finding that the dissimilarity of the metals did not impair the value of the result, he tried several pairs in order to discover which would give the most distinctive sound. The embedded metals for which the surgeon had usually to search were lead, nickel, copper, iron, and some of the iron alloys used in shell manufacture, while the surgeon's instruments were usually steel, silver, or nickel-plated. With any of these instruments attached to one terminal of the telephone, he found that on contact with any of the above-mentioned metals, the loudest sound was elicited when a plate of carbon, such as was used in an ordinary bichromate cell, was attached to the other terminal. The currents generated were, naturally, small and of low pressure, and it was necessary to reduce the resistance of the body by using as large a plate of carbon as possible, and to increase the conductivity of the skin by moistening it with salt solution. He found that a cheap telephone of 60 ohms resistance, costing only a few shillings, detected these small currents better and gave a louder sound than the more expensive high-resistance telephones used in wireless telegraphy.

Sir James demonstrated his method of procedure, which consisted in the use of a telephone with double receivers for attachment to the surgeon's head, one terminal of the telephone being brought to the carbon plate, and the other to a disinfected silver wire which was bound round or clipped on to the knife, probe, needle, forceps, or whatever instrument the surgeon might wish to use. The instrument, on first contact with a bullet, gave rise to an unmistakable click on the telephone, and, when a rubbing contact was made, to a distinct microphonic rattle, and under this guidance the embedded metal could be extracted.

The lecturer added that he had found no special advantage result from the introduction of a battery into the circuit. One modification which might be employed, in the case of a surgeon whose hearing was not acute, was to pass the current, not through the telephone, but through a suitably wound galvanometer, when the movement of the galvanometer needle would indicate contact with the metal, or the arrangement could work as a relay, and a bell could be made to ring every time the bullet was touched by the surgeon's implement.

Sir James, whose demonstration obviously impressed his fellow surgeons, prophesied that a time would come when no surgeon would attempt to remove a deeply embedded metallic body without having this telephone attachment at hand.

# THE SHAPE OF THE PRESSURE WAVE IN ELECTRICAL MACHINERY.

Part I, by S. P. SMITH, D.Sc., A.M.I.E.E., and R. S. H. BOULDING, B.Sc. Part II, by S. P. SMITH, D.Sc.

(*Abstract of paper read before the* Institution of Electrical Engineers, *January 14th*, 1915.)

In Part I the electromotive force induced in windings is determined analytically, and the effect of flux-swinging is investigated. The importance of the winding factor is emphasised. Experimental confirmation is given wherever possible. (No attention must be paid to the relative magnitudes and phase displacements of the oscillograms here reproduced.)

In Part II an attempt is made to amplify and illustrate the analytical results obtained in Part I, by means of the vector diagram and by examples. Also the advantages of using the vector diagram of the fundamental for studying the circuits in a double-layer commutator winding are shown, and simple rules for obtaining the positions of the various phase tappings and connections are given.

One of the greatest advances that have been made in the development of electromagnetic machinery during the present century is the approach in the shape of the pressure wave to the ideal sine curve. Several reasons have combined to bring about this result. Thus the wide extension of the three-phase system with star-connected generators has removed from the interlinked or line pressure the third harmonic, which is sometimes considerable in the phase

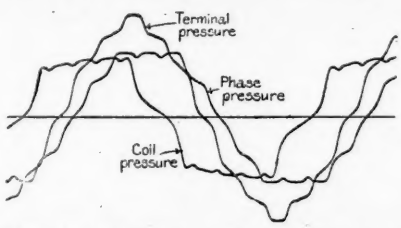



Fig. 1.—Oscillograms Showing Spacing Ripple in Phase and Terminal Pressures of Three-Phase Salient-Pole Alternator, Having Six Semi-Closed Slots per Pole.

pressure. Again, the adoption of the non-salient-pole construction for the rotors of turbo-alternators has made it possible to obtain a flux distribution which remains nearly sinusoidal under all conditions of load. Finally, the designer has also learnt what refinements are necessary in order that the pressure curve may be free from ripples.

Although there are cases where the shape of the pressure wave is not important, there is no doubt that the pure sine curve is best for general alternating-current working. Thus, the troubles occasioned by earthing the neutral, which is now common practice in central-station working, are mainly due to the existence of a third harmonic in the phase pressure. Cases arise also in the parallel working of synchronous machines where the interchange of wattless currents due to the higher harmonics becomes excessive. As an instance, a case may be cited of a six-phase rotary converter working direct off a six-wire, three-phase generator,

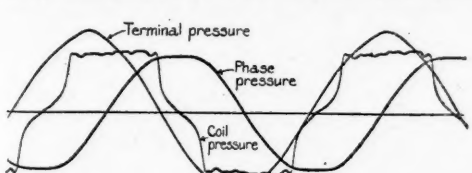



Fig. 2.—Oscillograms Showing Suppression of Spacing Ripple—due to Fractional Number of Slots per Pole—from Phase and Terminal Pressures of Three-Phase Salient-Pole Alternator. Opened Wave Winding—108 Slots (Semi-Closed); 16 Poles; 6·75 Slots per Pole.

where, owing to the harmonics, the current taken when the converter was running light was equal to the normal full-load current.

Numerous other factors of varying importance, such as low losses and high power factor in the system, safety in high-tension working, freedom from disturbances to telephones, and from resonance, &c., all demand an absence of harmonics. Also, when a four-wire, three-phase system is used for a lighting supply, the use of a pure sine wave results in the ratio, phase pressure to star pressure, being constant.

The sine curve is the most natural standard, and it is generally attainable, which would not be the case with other wave shapes. Also, the majority of our simple calculations and vector diagrams are only possible on the assumption that the quantities in question vary sinusoidally.

In Sec. 1, under the head of "Classification of Windings," the authors show that where the number of slots per pole is an integer, and a normal arrangement of slots and poles is adopted, the effect of the teeth on the wave form will be greatest (fig. 1). When the poles or slots are skewed in such a manner as to make the conductors occupy all possible positions in the field, the winding is equivalent to a uniformly distributed winding, and the effect of the teeth is *nil*. When the pole-shoes are displaced, or the number of slots per pole is fractional, the equivalent distribution of the winding is increased (fig. 2).

In all cases where there is an abnormal arrangement of the field or armature system, or a fractional number of slots per pole, it is allowable in practice to regard the winding as uniformly distributed.

In Sec. 2, a general expression for the electromotive force induced in a coil is obtained. When a coil moves relatively to the flux, an electromotive force of motion or rotation is said to be induced in it, whilst if the flux itself varies, an electromotive force of pulsation is induced. With continuous-current excitation the flux is steady, except in so far as pulsations are set up by the teeth or by armature reaction. It is here assumed throughout that the machine is unloaded. It is shown that the curve of electromotive force induced in each side of a coil is identical in shape with that of the flux distribution, but the two pressures are only in phase when the coil spans a full pitch. The coil-span factor can

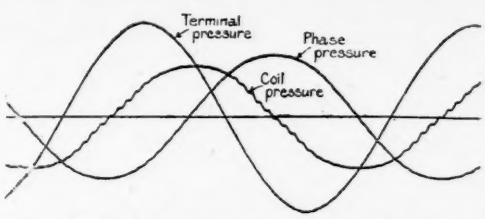



Fig. 3.—Oscillograms showing Effect of Rotor Teeth of Non-Salient-Pole Turbo-Alternator, 24 Stator Slots, nearly closed; 40 Rotor Slots closed with Cast-Iron Wedges, 1f/20 Wound; 2 Poles. Rotor Slotted uniformly over whole Periphery.

effectively suppress certain harmonics in the induced pressure. For instance, if the coil spans two-thirds of a pole-pitch, the third harmonic disappears.

In Sec. 3, the electromotive force induced in a circuit of a winding by rotation in a steady field is investigated in detail, and tables of distribution and reduction factors for various windings are given.

Incidentally it is shown that there can never be a third harmonic in the line pressure of a star-connected three-phase generator, nor in the alternating pressure of a three-phase rotary converter, nor in the phase pressure when each phase extends over two-thirds of the pole-pitch, nor in the pressure of a single-phase alternator with two-thirds of the periphery wound. This also holds when the winding is placed in slots instead of being uniformly distributed. In a similar way, when the spread of winding equals two-fifths or four-fifths, no harmonic which is a multiple of 5 can appear in the pressure curve.

The effects of the slots in the rotor and stator are considered, and it is shown that when the numbers of slots per pole-pair on the stator and rotor are equal, or only differ by two, a very pronounced ripple of a high order may appear in the pressure (fig. 5)

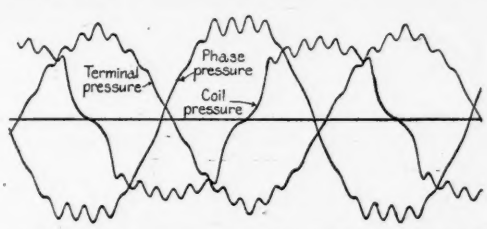



Fig. 4.—Oscillograms showing Tooth Ripple due to Flux Swinging in Three-Phase Salient-Pole Alternator with a Whole Number of Slots per Pole. Open Slots.

The spacing ripple in salient-pole machines is chiefly important with two or three slots per pole and per phase, and unless one of the several methods for making the winding factor very small is used, it is generally advisable when a smooth pressure wave is needed, to round off the pole tips so as to reduce the harmonics. With non-salient-pole machines, the number of stator slots per pole is generally larger, and the chief care must be taken to avoid clashing with the number of teeth on the rotor.

The effect of flux pulsations due to teeth is dealt with in Sec. 4. Since most of the flux is carried by the teeth and very little by the slots, there is always a tendency for it to move as the teeth enter and leave the pole-arc. When the magnetic path in the gap has a constant reluctance but variable position, the flux will swing to and fro; when the reluctance varies, the flux will change in amount. It is probable that both these movements take place to some extent in all slotted armatures, though the former is alone of importance, as a rule.

Unless the whole magnetic circuit is well laminated the change in the flux can never be very large, since there will always be a tendency for oscillations in the magnitude of the flux to be

damped out by eddy currents and currents induced in the exciting winding. Both experience and experiment confirm this view.

The E.M.F. ripple due to swinging of total flux is of much greater importance, since with laminated shoes there is comparatively little hindrance to the flux swinging. In the worst case the magnitude of this swing would equal the flux of one tooth, and from oscillograms it is often found to exceed one-half of this amount (fig. 4). The larger the number of teeth per pole the smaller the possible swing.

The amount of flux swinging depends largely on the constructional details of the machine, such as the number of slots per pole, the ratio of slot-opening to gap, the skewing of the slots or pole-

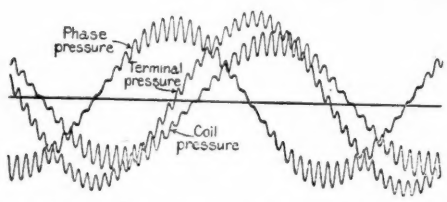



FIG. 5.—OSCILLOGRAMS SHOWING COMBINED EFFECT OF TOOTH RIPPLE AND SPACING OF ROTOR SLOTS IN THREE-PHASE NON-SALIENT-POLE TURBO-ALTERNATOR. STATOR: 36 SEMI-CLOSED SLOTS; ROTOR: 34 SEMI-CLOSED SLOTS WITH BRASS WEDGES, 14/17 WOUND; TWO POLES. ROTOR SLOTTED UNIFORMLY OVER WHOLE PERIPHERY.

shoes, &c., and by suitable design it can be made fairly small. The commonest method for reducing the swing is to use nearly closed slots.

Fig. 5 shows the effect of an unsatisfactory choice of numbers of slots. In fig. 6, instead of only having the required number of slots, namely, 144, there were 150. The machine had open slots. As we should expect, the pressure induced in a conductor reveals a fairly strong tooth ripple, thus proving that the flux was swinging. In the coil pressure, the ripple is already reduced, owing to the fact that the electromotive forces are not identical in phase; whilst the phase and terminal pressures are quite smooth.

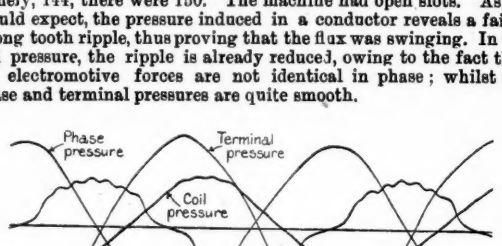



FIG. 6.—OSCILLOGRAMS SHOWING SUPPRESSION OF TOOTH AND SPACING RIPPLES FROM PHASE AND TERMINAL PRESSURE OF THREE-PHASE SALIENT-POLE ALTERNATOR WITH A FRACTIONAL NUMBER OF SLOTS PER POLE. 150 SLOTS (OPEN); 16 POLES; 9·375 SLOTS PER POLE.

There are external methods of suppressing the tooth ripple from the terminal pressure. For example, a method that has found favour of late years has been the use of a resonance circuit across the terminals of the machine, adjusted to resound with the frequency of the tooth ripple; though in most cases the addition of one or two extra slots would certainly be a much cheaper and an effective way of preventing disturbances in telephones.

Regarding the effects due to the slots and teeth, it is obvious that in general it is possible to build machines nowadays in which all such effects are eliminated from the pressure wave.

---

### DISCUSSION IN LONDON.

DR. S. P. THOMPSON said the paper formed a brief account of the state of affairs, as known and added to by the authors, at the present time. No doubt many of the things mentioned had been touched upon by previous investigators; but the authors had succeeded better than any before in investigating the effect of ripples, and it would be as well to provide some adjective to distinguish between ripples due to stator and rotor slots. Amongst other things, the authors had given them a new definition of "circuit" which it would be difficult to apply generally. The authors enumerated the advantages of the pure sine wave, but also reminded them that they should have the flux form a pure sine curve, as then there would be no need for devices to correct it. The non-salient form of pole properly wound was better for flux distribution, and was better from the mechanical point of view. He thought it would be advantageous to simplify the mathematics for those who would make practical use of the paper in the future, and as it stopped short of certain matters, perhaps the authors would follow it up.

MR. BURGE said, with the exception of turbo-alternators, pole slots could not be slanted, as they were usually laminated. He wished the authors had not set aside the question of wave form on load; he mentioned this in regard to the proposal to use alternators with poor regulation instead of reactances.

MR. C. C. HAWKINS said the authors had not mentioned the use of the mid-coil arrangement for suppressing certain harmonics; it was not right to be satisfied when the harmonics were reduced to very small proportions, as they might give rise to very serious effects. The authors were rather uncertain on certain matters regarding flux swinging; he thought it was agreed that with fringing the conditions were reversed. He thought it was necessary to have the whole circle of polar fringe in order to make reliable deductions as to swinging.

MR. A. R. EVEREST said the salient-pole rotor could be made to give just as good an approach to the sine wave as the drum type. He thought it was obviously impossible to adopt irregular slotting or spacing of coils on a large scale for manufacturing reasons; a fractional number of slots per pole was a good method. He believed the American Institute allowed as a standard any harmonic not to exceed 10 per cent. of the main wave, but a newer standard was proposed.

DR. HOWE emphasised his belief in the correctness of fig. 19 in the paper (in regard to which it may be mentioned that an alternative unsymmetrical figure had been discarded as being doubtful). It ought to be quite clear whether reference was made to ripples or to the harmonics into which they were divided.

MR. JAKEMAN did not think it practicable to use an extra slot as suggested, except for single-phase machines, and taking all points into consideration he thought higher harmonics might still be present if extra slots were used.

The AUTHORS, in replying, said the effect of load was now being considered. DR. SMITH explained that they were not advocating anything in particular, and were investigating everything that came along. He had not yet arrived at a conclusion as to the correctness or otherwise of the unsymmetrical edition of fig. 19.

---

### DISCUSSION AT MANCHESTER.

PROF. MILES WALKER said the authors were to be congratulated upon having given a solution of what had always been regarded by designers as a very troublesome problem. Present-day engineers had found from experience the desirability of keeping down the ripple in the E.M.F. wave as much as possible. Some engineers even inserted a clause in the specifications regarding the percentage ripple allowable, and this might be 1 per cent. or over. The main difficulty with the designer had been to predetermine the amount of ripple; it was a comparatively simple matter to take the E.M.F. of a single conductor in a machine and so determine the field form, but it was quite another matter to deduce from the field form the final E.M.F. wave form. This was the problem the authors had solved. The tables given enabled the designer to predetermine without any trouble the value of any harmonic in the final E.M.F. wave form. It was to be hoped that the authors would pursue their investigations and give the results of full-load working in addition to the no-load results recorded in the present paper. The paper was an admirable case of applied mathematics producing tables of real commercial value.

MR. K. M. FAYE-HANSEN, speaking from the point of view of an alternator designer, said that most of the conclusions were known to the specialist designer, but they had never been brought forward in such a clear manner and arranged so that the result of higher harmonics could be easily predetermined. The employment of fractional windings was a useful expedient and gave excellent results, but sometimes there were economical reasons against it, the chief of which was the use of parallel connections.

PROF. FIELD said that the extent to which a slight ripple might be of great practical importance was illustrated by the fact that purchasers' specifications usually limited the no-load value, whereas the value of vital importance was the full-load operation; it was very hard to specify that, because it was necessary also to specify the nature of the load. In the case of a machine which it was required to delta-connect, it was of great importance to investigate the matter in advance and see that the third or seventh harmonic would permit delta-connection without serious circulating currents. Unless special precautions were taken, serious trouble might arise from the ninth harmonic. In the case of the New York Edison Co. and several other stations in the U.S.A. the original operating voltage was 6,600, but the plant was arranged for ultimate conversion to 11,000 volts; in consequence the large generators were arranged to be delta-connected. In most cases the turbo-alternator had been wound with a two-thirds coil pitch, which completely eliminated the third and ninth harmonics. He took exception to the authors' statement to the effect that on alternator work a full-pitch winding was usually employed. In the States it was more common than otherwise to have a chorded winding on alternators, particularly turbos. In order to illustrate the comparatively big effect of a very small harmonic, he cited the case of a machine with the winding chorded not quite two-thirds, but two-thirds plus or minus one slot. The effect would be almost completely to wipe out the third harmonic, the only effective amount being due to the discrepancy of one slot. The value of the third harmonic might have been considered too small to be of any account, but the ultimate burning-out of windings in slots where the coils crossed was found to be due to this circulating third harmonic current together with the extra losses due to high frequency.

DR. G. W. WORRALL, in a written communication, said that his general impression was that the authors had not sufficiently considered the individual ripple E.M.F.'s generated; the ripples in the conductor might be considerable, although the wave of terminal pressure was quite smooth. When several conductors were connected in parallel, the ripple E.M.F.'s sometimes produced circulating currents which caused unequal local heating of the machine. The ripples also caused vibration of the teeth, and serious breakdowns were by no means uncommon, which were without doubt due to this cause. There must, of course, be a certain amount of looseness in the stampings to allow the vibration to take place, but

such looseness might not be due to defective manufacture in the first instance. During the past few months two machines broke down in this way, one, a slow-speed alternator, after a few weeks' running, and the other a high-speed turbo-alternator after eight years' running. It was, therefore, of the utmost importance to suppress the ripples as far as possible in each conductor, and not merely cancel them out in the aggregate.

Mr. R. S. H. Boulding, in reply, said the only way to get rid of ripples was to avoid swinging, which could be approximately carried out by the method mentioned in the paper. Whilst the paper was confined to no-load effects, the same method applied to full-load considerations, and the results were to be regarded as qualitative rather than quantitative.

Dr. Smith, in reply to Mr. Faye-Hansen, said considerable difficulty was experienced with the shops in regard to cutting extra slots. No doubt it was a commercial question. The question of parallel circuits was very important; in the case of a two-pole machine it was practically hopeless, but with a four-pole machine two extra slots across a diameter were easily added. Generally speaking, it did not cost as much to have two extra slots as to chamfer the pole-pieces. Prof. Field mentioned the case of machines which did not have identical circuits; the whole paper went to show that identical circuits were necessary. Unsymmetrical windings were not to be advocated, and there was no reason for departing from this excellent rule.

## ELECTRIC HEATING AND COOKING.

At the last meeting of the "Point Five" Association, held in London on January 15th, Mr. Hefford, of Leeds, was elected a member.

Mr. Harold Gray, of Accrington (the Chairman), an abstract of whose remarks we give, said that in many undertakings there are other users of equal or greater importance than those in the domestic field. A suitable domestic tariff has been formed and established, and it is time that the efforts of the Association were concentrated on reclaiming another field, the trading class of property covering shops, hotels, etc. The enormous variation in the rateable value of this class of property depending on its position is a serious drawback to the elaboration of a rateable tariff.

A rate based on a sliding scale of percentages on rateable value and a fixed price per unit worked out as the result of combined experience, is a tariff which could be utilised advantageously and with profit to all concerned. The higher rated premises would have a lower percentage charge on the rateable value than the smaller ones. The general lines of the tariff being arrived at, it could be pigeonholed until an opportune time arrived to put it into force in a particular district. There are now a number of big shops which use artificial light in their interiors for all the working hours of the day and for many months in the year, for which where a flat rate of charge is in force gas illumination is employed. This would at once be rectified if a tariff on the above lines were in force.

The writer communicated with leading manufacturers asking them to state how their sale of apparatus compared in "Point Five" undertakings and others; the replies without exception indicated that for a given size of undertaking the demand for appliances is considerably in excess of that in flat rate districts. This explains why Association members are given favourable buying terms and why the suggestions of its members for improvement or alteration in apparatus are at once put in hand and often made their standard selling line.

On the subject of apparatus, if the result of sales is an index, the hot bar fire is rapidly superseding the lamp radiator as a heating medium except in special cases. There is the advantage in the former that toasting and grilling in a "Dutch" oven, etc., can be effected and the renewal of sections is cheap.

While on the question of heating, mention might be made of a somewhat interesting experiment carried out a few weeks ago. The congregation in a church suffered on Sundays from a severe down draft, and the electrical department were asked to put the matter right. It was handled as follows:—A ring of hot bar strips covered with expanded metal with occasional gaps was run round the nave of the church at a height of 21 ft. from the floor and 15 ft. from the top of the main aisle. The total loading of the heaters was 20 kw., the switching arrangements being such that either 10 or 20 kw. could be applied. This circuit is turned on first thing in the morning with the ventilators in a definite position to create an upward current, and thus get rid of the humid atmosphere in the building, and the writer is assured that the trouble has now been cured. A development of this application would produce quite a useful Sunday morning load.

The type of vacuum cleaner most suitable in a particular class of house still appears to be an open question. For big houses the use of a central permanent installation with pipes run to various points and flexible hose pipes and appliances coupled from these points is probably the only entirely satisfactory arrangement. The machine of the carpet sweeper type in which the motor is wheeled along is convenient in use in that it has no flexible hose-pipe to handle, but it is not very handy for cleaning under low furniture. This type almost invariably collects the dust in a bag, and it is noticeable that in some cases the exhausted air is not as pure as one could desire. The other type in use is that in which the cleaning apparatus is carried to a convenient stationary position and flexible hose-pipes and attachments worked from the machine in this position. This type has the advantage that cleaning can be done effectually under very low furniture and on walls, etc., without much trouble, but the heavy flexible hose-pipe is rather awkward to manipulate.

As regards electric cookers, a thoroughly reliable article can be obtained at a reasonable price provided all elaborations are excluded. A cooker built on similar lines to a gas cooker, of cast-iron, having removable fittings, with hot plate and grill on the top of the oven and without circuit indicators, thermometer and inspection window, etc., appears to give satisfaction in the majority of cases (*i.e.*, its operation is better than a gas cooker) and perhaps generalising, the simpler the machine the less trouble it will give in the long run.

For better class work where the customer will pay an increased price, useful elaborations are much valued; thus there appears a tendency where there is room to have the griller and boiling rings removed from the oven and put on one side. The oven can, of course, in this case be raised to a more convenient height. Indicating lights to show which circuit is in use are also useful and a thermometer, once its value is tested, is invaluable. There does not appear to the writer any valid reason why the simpler class of cooker mentioned above could not now practically be standardised in order that quantities could be manufactured in big batches and the selling cost reduced.

The standardising of hot plates might present difficulties; it is probable that the radiant heat (red hot) plate will be ultimately the most satisfactory type. Rapid operation can never be effected if the heating element has to heat up an iron plate as a preliminary to the heat being passed on to the cooking vessel.

The question of the pressure of supply to heavy current consuming devices is now becoming important. Should a consumer put a balanced load on the distributor (*i.e.*, on the outers of a D.C. network or three-phase on an A.C. network) or should he have an ordinary lighting service? Simplicity certainly dictates the latter course, and in thickly supplied areas consumers demands can be fairly well balanced, but in our district, in one or two isolated cases we have adopted the former course to avoid objectionable effects on the local lighting.

It is interesting to find that in the Accrington district more appliances have been connected to the system during the last three months than in any preceding quarter of the history of the undertaking.

### Discussion.

Mr. Pickvance, who opened the discussion, said the objects of the Association were, according to the Articles, simply to foster the consumption of electrical energy for domestic purposes. Without any reconstruction of rateable value tariffs, but simply by means of an active business propaganda amongst the shopkeepers, the Chairman could, no doubt, have a higher percentage of shop lighting consumers than he possessed at present. Shop lighting did not need the aid of a special body of engineers for its development. A plain flat rate, with a reduction according to quantity consumed, should meet with a favourable reception, especially if followed up by a proper system of business development. He disliked the differential percentage charge; any variation of the fixed charge, according to the size of the rateable value, seemed to be a most unorthodox way of applying the rateable value system. Although strongly in favour of this tariff for domestic purposes, he did not see how it could be applied to shop lighting and business premises generally. They would certainly have trouble with the different classes of consumers. As regarded that class of consumer who used artificial light during the daytime, this was met in Wrexham by a very simple tariff which provided that the amount used beyond a certain number of units per 8 c.p. or 30-watt lamp, per quarter, should be charged at a reduced figure, less than half the amount of the ordinary flat rate. It worked remarkably well as regarded hotels and large shops, and was automatic in this application, particularly as regarded those few shopkeepers who used the electric light principally for window lighting and had gas at the rear of their premises.

Mr. Allen did not see how the rateable value system could be applied to shops, but thought the objects of the Association were quite sufficiently definite, and that it had an enormous field in front of it in domestic supplies and appliances, and that it was unnecessary to widen the scope of the Association to take in other classes of supply. In his opinion it was better to tackle one thing and do it thoroughly. He had carried out some useful experiments with nichrome No. 2 wire, and mentioned that after maintaining a coil of wire at red heat for two months in oxygen no sign of oxidisation could be seen. He did not believe that the present time was a suitable one to attempt standardising cookers, as the development was so rapid and might turn along totally different lines to the present.

Mr. Barham considered that for new domestic supplies a two-rate system was all that was required. He emphasised the drawback to the industry of the want of hiring powers.

Mr. Grogan also considered that it was impossible to apply the rateable value system to shops, and advocated a sliding scale method of applying the rateable value system to residences in some districts. Mr. Grogan made some useful remarks on the heat distribution in ovens, and gave a description of a large electric restaurant in Derby at a cinema palace. He gave the working details of the restaurant, and added the information that the proprietors were entirely satisfied with the result.

Mr. Shaw (Ilford) considered that a suitable tariff for shops was the well-known maximum demand system, which he had found quite satisfactory, the rateable value system not being applicable. He also pointed out that it was impossible to push heating and cooking apparatus, even with a low tariff, if the electric supply authority was not in a position to hire out the apparatus. He found that amongst his consumers the hot-bar type of heater was far and away the most popular.

Mr. Roles (Bradford) found that in his district the demand for lamp radiators had dwindled to practically nothing. As regards the hot-bar type of heaters, the trouble had been to get them from the makers, not to sell them. Mr. Roles referred to the fact that in Bradford many consumers were utilising hot-bar heaters for other purposes than heating rooms, namely, for making toast and for warming in connection with the preparation of food.

Mr. Nevill (Wakefield), one of the most recent "Point Fives," gave some interesting figures showing the great increase in his business since the Point Five tariff was instituted for heating and cooking. He also referred to the considerable increase in the use of electricity for heating shops; and mentioned that his peak load had not been affected by the increase in heating and cooking. It was the same amount in kw. that it had been for over ten years. He also mentioned that he had been inquiring for a long time for a manufacturer who could provide a satisfactory equipment for heating the type plate of a box side branding machine. Suggestions had been made on one or two occasions, but not of a nature likely to prove satisfactory.

Mr. Cooke (Luton) urged the flat ½d. for all heating and cooking without any annual charge, and gave interesting figures from his own district in support of his contention that this was a paying business proposition.

Mr. Beauchamp (West Ham) referred with appreciation to the Chairman's method of preventing down draughts in public buildings, which he had also found to be successful and economical. He also drew attention to the use of electric heating stoves which consisted of a combination of radiant and convecting elements, pointing out that by the use of either or both features the maximum economy and comfort in heating rooms could be obtained. Referring to Mr. Cooke's remarks on heating in shops, Mr. Beauchamp drew attention to the fact that shop-heating in general could not be expected to have the same high diversity as domestic-heating, and whilst, like domestic-heating, it was to a great extent winter business, yet a large proportion of it might be expected to come on across the winter peak, a consideration the importance of which would, of course, vary with the undertaking supplying energy.

Mr. Tapper (Stepney) gave his experience that the maximum demand system met the requirements of nearly every class of consumer. One explanation was that, owing to his consumers being chiefly long hour users, they obtained low average rates. If he made any change in his tariff for domestic purposes to meet the cooking and heating business he should carefully consider, first of all, the two-rate meter system.

Mr. Long (Norwich) hoped to qualify before long for membership of the "Point Fives," and was seriously considering the adoption of this tariff. The point he was most concerned about was whether it was safe to give a flat rate of ½d. for radiators used in shops without any addition to the fixed charge. He was satisfied that this could be done in the case of private houses as the diversity factor was very great, and comparatively few would be on at the peak, but in shops one would expect the majority to be in use then. He was interested to know from several speakers that in their experience the use of radiators in shops was, as a rule, reduced in the afternoon before the peak load. In Norwich the fixed charge for shops and business premises was based on the estimated maximum demand for lighting.

Mr. Shaw (Worcester) was very busy converting lamp heaters to hot-bar, which could be remodelled at a very small cost, thus converting them from obsolete appliances to quite up-to-date ones. Speaking on the life of cookers, he mentioned that some flour mills in Worcester had a cooker for baking and testing bread, which they had had in continual use for nearly 20 years. It was made by a Chelmsford firm.

Mr. Shaw stated that if an electric soldering iron, with cheap renewable elements, for industrial purposes could be put on the market, which would be satisfactory, and which he could recommend to his consumers, there would be a use for 900 to 1,000 in one canister factory alone.

The Hon. Secretary agreed that the domestic field provided a sufficiently large one for all the energies of the Association. All undertakings have a residential area as well as a business area, and, therefore, all stations had an interest in developing domestic supplies. Besides, electric power was well catered for already: it was almost standard and was extremely easily catered for, both as regards apparatus and tariffs. For premises other than residential he thought the Hopkinson tariff with an annual charge plus a small secondary rate per unit met all the requirements, and he could not agree with the Chairman that shop lighting, hotels, etc., was a more difficult class to handle than the residential business. He was rather surprised no members had referred to the new method of heating rooms by thermostatic control. The effect of this would be largely to reduce the current consumption and put electric heating within the reach of many who could not afford it at present. He gave an example of a large thermostatically controlled electric hot water system which had been installed at Oxford Circus convenience for wash basins. The cost at present was slightly lower than for gas, and he could see his way to reducing the cost still further by at least 20 per cent. He mentioned a block of flats being erected in his district that were being cabled for heating, cooking and lighting by the builders. Electrically-heated hot water was also being installed, and the estimated consumption per annum of this block of flats was one million units, or 2,500 units per head of population. One was accustomed to looking to a block of flats of this size for 50 or 60 thousand units per annum as a maximum, and this example alone showed the enormous field still untouched for domestic supplies.

## BREAKDOWNS IN COLLIERY ELECTRICAL PLANT.

By LLEWELLYN FOSTER.

(*Abstract of paper read before the* Association of Mining Electrical Engineers (Lancashire Branch)).

Generally speaking, breakdowns of mining electrical plant may be divided into three classes:—(1) Those caused by lack of proper attention and care, including want of systematic periodical opening out of the machines for inspection, cleaning and general overhaul. (2) Those due to the machines being quite unsuitable for their work and situation. In mining work particularly, open or protected-type machines are often used when they meet the requirements of the Regulations, whereas, on account of the surrounding dust and dampness, the enclosed type should have been used. (3) Those due to faulty design, defective material and workmanship.

It is very seldom that we find any system of periodically taking machines apart for overhaul; if the windings were kept clean and varnished occasionally, a number of breakdowns would be prevented. At one colliery in the north of England there are seven Hopkinson coal-cutters in use, and the machines are only allowed to work in the pit for three weeks continuously. After that period each machine is brought to the bank to be overhauled.

One of the most frequent sources of trouble in electrical plant in mines is due to the fact that a machine is left running as a single-phase owing to one of the three fuses having melted, or possibly to there being a defective circuit on one of the three phases. Fuses that are large enough for the starting current of a squirrel-cage motor are usually too large to be any real protection when the motor is running. It would seem, therefore, that having two sets of fuses and switching over from "starting" to "running" fuses would be a simple solution of this difficulty.

A considerable proportion of breakdowns occur in the commutating parts of continuous-current machines, viz., commutators, brush-gear, etc., and sparking at these parts does not receive the careful attention it requires.

Fractured conductors, fractured commutator spokes, and flats on commutator bars are mostly due to vibration, and through consequent chafing and pounding of the insulating material "earth" faults are caused.

Regular measurements of the radial air gap should be taken and recorded, as well as the test of lifting the shaft in its bearings. Any movement in the bush or of the bush in its housing should be carefully observed. When the machine cannot be stopped, the condition of the bearing can be fairly well ascertained by inserting a pencil or rule in the oil well and letting it rest on the shaft, when any slackness will be noted by a movement of the pencil apart from the bearing housing or casting. The lighter the load the more positive will be the movement.

The switch blades and contacts of the stator circuit, and the fuse fittings and contacts require regular and systematic examination. All ends of cables, connections, etc., should be soldered to prevent the danger of the machine running on incomplete phases. When installing an "in-bye" motor, means should be provided for access to all parts of it. Some pits are naturally very wet, and breakdowns frequently occur through dampness percolating into the windings of the motors and to the starting gear. This causes "earthing" of the winding, and the trouble generally occurs at the end of the slots in the armature or rotor core. The percentage of breakdowns due to this cause would be considerably reduced by making properly constructed motor rooms, with the foundations laid out in such a manner that when the motor was installed on its bed it would be, say, 6in. or 8in. above the floor level.

Breakdowns on underground plant are frequently due to bad foundations, etc., which set up excessive vibration. Many armature breakdowns are due to mechanical defects in the driven machinery.

On some colliery plants where originally protected-type motors were installed, these have been converted into totally-enclosed machines, but without any reduction of the load. The reduced rating of a motor when totally enclosed is often lost sight of by the manager, who is usually responsible for having the motor made totally enclosed.

In the earlier days of electrical work in collieries, a bed built up of rolled-steel joists was fairly frequently met with, but the cast-iron box bed has quite superseded it. In cases where the rolled-steel joist beds are still in use it is important that they should be securely held down and well grouted in. There should be a holding-down bolt close up to each side of each bearing pedestal and each stator foot. The greatest vigilance should be exercised to prevent any of the bolts connecting the frame together from slackening back. Care should also be taken that the steady pins go right through the flange of the joist, and these steady pins should be frequently examined.

Machine-cast steel wheels should always be used for the first reduction from the motor, and should have their pitch circles marked so that they can be properly meshed. The use of "machine-moulded gearing" for such work as this is not likely to prove economical.

A 100-H.P. three-phase motor drove a haulage through gearing. The rotor and stator came into contact, and one coil in the stator was "earthed." The radial air gap was regularly measured twice a week by the colliery electrician; apparently it had not appreciably varied for many months, and on the day before the failure the gap was 0.03 in. at the smallest part. On investigation it was discovered that the motor had its greatest load when the pinion was running towards the spur wheel, thus tending to wear the top halves of the bushes. It is obvious, therefore, that a rotor may be perfectly central whilst at rest but not necessarily so when running. The makers should so design their end covers that the radial air gap can be watched whilst the machine is at work. The writer strongly recommends two "inspection doors" in the back end cover for every type and size of A.C. and D.C. motor, as this would very considerably aid in clean- special care and attention.

## TRADING AND INDUSTRIAL METHODS IN GERMANY.

BELOW are given some extracts from a report on the trade of Germany by Sir Francis Oppenheimer, H.M. Commercial Attaché in Germany, which has recently been issued by the Government. The report itself may be obtained from Wyman and Sons (Cd. 7620-14, price 5½d.)

*The Growth of Syndicates.*—Germans, in every stage of society, are prone to combination; in Germany there is hardly a branch of manufacture or of trade, however special, which has not its own organisation and probably its own journal. Manufacturers all over the Empire, producing the same goods, are brought into touch either personally or in print. The conditions of the whole home market are thus disclosed; its chances are weighed and scrutinised. The more a works specialises (and the tendency owing no doubt to the very keen home competition is all towards specialisation) the more must it co-operate with, and the more has it to rely upon, other branches of manufacture; their trade conditions have to be watched in turn. The specialist is brought into contact with the outside world. News from abroad is published and carried into distant workshops. The profusion of trade and professional papers can be gauged from their catalogue numbering 300 closely printed pages. That no branch is forgotten may be gathered from the fact that there figures among them a fortnightly magazine dealing with the interests of the foremen of platelaying gangs on the Prussian State railways (founded in 1906)! The keen competition among trade papers has produced a high standard. Much ingenuity and care is spent upon the reports of the industrial weather, with the result that no man need be taken unawares by a change of the tide.

Above all, it is the syndicates that exercise a steadying influence. This side of syndication has repeatedly been explained. Syndicates control production and sales, and, when the home market is satisfied, help towards directing merchandise abroad. In an atmosphere of industrial depression syndicates are seen to their greatest advantage—at least by their members. It is then not surprising that in 1913, and to a greater extent in the early months of 1914, syndication—the renewal of old syndicates and the foundation of new ones—should have been one of the most frequent subjects discussed in the commercial Press.

There is no doubt that after each successive boom the desire for syndication is strengthened and, at the same time, its accomplishment is rendered more difficult. The desire is strengthened because every boom gives the members of the various industries a chance of extending their works and raising their capacity of output—which means an increased production and, in consequence, an increased competition during a slump. In the first quarter of 1914 prices of unsyndicated goods reached what seemed to be the lowest possbile limit. Yet the cry for syndication became louder as the depression progressed.

The difficulties of syndication are augmented because every boom gives a further advantage to the giant works which have virtually concentrated the various stages of manufacture under one roof. They have little interest in the various syndicates controlling the respective stages of manufacture unless they are granted preponderant figures of participation, more especially in the final stages. As the smaller works, whether syndicated or not, are greatly at the mercy of these giants, they naturally prefer a state of syndication which guarantees their existence, checks competition, secures steady prices in the home market, and provides export bounties for foreign orders. For the giant concerns, syndication means financial sacrifices; but these sacrifices are expected of them as they are the princes of industry, the pillars of Germany's economic life. Their concerns have become world concerns. They embrace so many branches of manufacture, they command so many markets, that they reach above local industrial tides. The rise of such works, although it has been greatly assisted by the modern developments of German banking, is chiefly due to the application of science to manufacture. These leaders have increased their profits by carrying the science of by-products to its utmost limits, and they have thus very materially reduced their cost of production. They are generous and indefatigable where scientific research is concerned. A succession of booms has made these mammoth concerns financially independent.

*Their Influence at Home.*—The financial power to which they have attained is used for, amongst other objects, the acquisition of their own means of transport. The reason is that all the world over the item of transport is gaining an additional importance in the faculty of competition. Some powerful mining-shipping combinations are an example of this development.

The most recent development in the matter of concentration is perhaps the most interesting of all. To guarantee a steady sale of their vast output some of the big works began to effect a financial combination with their own consumers, thus following on an extensive scale an example set by the electrical industry. An important works, manufacturing machines for use on railways, has bought up a company letting out railway machinery; the firm of Krupp has bought up two shipbuilding yards; a leading factory producing electrical appliances and machinery has obtained control of an electrical power supply company.

These gigantic concerns exercise a steadying influence upon the country's economic life because their interests are world interests. Whatever the industrial tide may be at home, they are vast employers of labour; in many communities they are the backbone of local finance; together they contribute colossal revenues to the public funds. It is not unnatural, then, that such concerns obtain facilities from the Government which would be denied to the smaller fry. These privileges in turn strengthen their position and give them an additional lead. They obtain the aid of the diplomatic and consular service and the financial support of the banks, so much craved by our manufacturers.

*Effect on Export Trade.*—The necessities of the German export trade have always enjoyed the special goodwill of the authorities. Under special export railway tariffs, practically all consignments below 5,000 kilos, and most consignments above, are carried to the coast or to the frontiers at reduced rates if intended for export. In some cases the rate is as low as 1.5 pfennig (¼d.) per ton-kilom. As under the terms of these through tariffs the German export must be carried in the ships of certain German lines, they constitute, in addition to the indirect export bounties, also indirect shipping subsidies. Early in 1914 a new postal convention was signed between the German and Swiss authorities, granting additional facilities to the German-Swiss and German-Italian parcel post service; it will also indirectly benefit German consignments in post office parcels to Spain, South America, and the Dutch Indies.

The German exporter has gained considerable advantage from the German shipping companies, who appear willing to initiate services with little prospect of profit in the immediate future. This policy accounts for the increasing proportion of trade directed to such smaller countries as Chile, Colombia, Siam, Morocco, the Philippines, Venezuela, Bolivia, Uruguay, etc. The North-German Lloyd was rumoured to be about to start a direct line from Germany to New Zealand. Again, manufacturers, merchants and shippers, interested in the same markets, have clubbed together to form special societies for nursing these markets so as to be able to lay their respective wishes with greater weight before the Imperial Government. Early in 1914, all these German foreign societies formed a union among themselves. The leading firms in certain German industries (metallurgical, electrical, chemical, construction) have become world institutions, with branches established, as separate companies, in many foreign parts; as witness the German-capitalised electrical concerns in Russia and in South America, where the D.U.E.G. is probably, with the exception of the Bagdad railway, the largest German foreign enterprise. From a mercantile point of view, there can be little doubt that so far the benefit which Germany has derived from

this private industrial colonisation outweighs the benefit which she has derived from her political colonies.

Increased means of production, the price policy pursued by the syndicates, the difficulties of some of the finishing industries in the home market, will help to explain the record figures of the German export trade in 1913. It will help to explain also why there is hardly a report published by the various Chambers of Commerce throughout Germany which does not contain some remark as to the unsatisfactory prices, the small profits, the price concessions which had to be made abroad to secure the necessary contracts. More particularly from the second half of 1913 onwards the necessity of a larger German export seemed uppermost in the public mind—the whole Press suddenly overflowed with articles of Germany's economic mission abroad, of what is called Germany's *Weltwirtschaft*. Again and again it was pointed out that among the three leading industrial countries of the world Germany found herself by a long way in the least favourable position. The United Kingdom had her vast colonial empire as a natural national market; the United States had a whole continent, while Germany, as the last comer, had no such privileged territories. As her colonies could, at best, be regarded in the light of future sources of supply for various raw materials, she must regard the world as her trading empire and rely exclusively upon her energies and enterprise to conquer it. Sometimes the limits were drawn somewhat more closely, and South America, Asiatic Turkey and the Chinese Empire were pointed to as her special trading areas.

The subject of commercial expansion abroad has been tackled, as is usual in Germany, both scientifically and practically, and, as might have been expected, called forth also two scientific institutions, and a new publication, *Greater Germany*.

The Government's paternal care for Germany's foreign trade has found a noteworthy expression in connection with the foreign loans placed upon the German market. Pressure has so long been brought to bear upon the leading banks that it has now become a recognised practice that, before a foreign loan is taken over, the Ministry of Commerce is consulted to ascertain whether the issue would be a desirable one for commercial reasons, though some financial quarters object very strongly to this novelty of what they call a financial protection. Very important commercial orders are thus being obtained abroad. The practice has already become so firmly established that something of an apology was published early in 1914, when part of the Bosnian loan was taken over by German banking houses without commercial concessions having been obtained. The Budapest municipal loan brought Germany a rich crop of industrial orders; the industrial demands in connection with the Bulgarian loan, which were admittedly onerous because the German money market was the only one available at the time, were greatly responsible for the failure of the negotiations on the original basis.

*Tendency Towards Standardisation.*—The desire to save expensive labour has naturally led also to an increased use of machines. The change has not been without its effect upon the traditional spirit animating German manufacture. At one time it was the pride of German manufacturers that they entered more willingly than others into a customer's special intentions. No doubt the inclination still holds good to some extent—yet a careful student can discover a change; the scramble is becoming more and more one for orders of standard patterns; difficulty is beginning to be experienced in finding manufacturers willing to accept those stray orders for goods which differ from the ordinary patterns. Once the machine has been set for a while the experienced workmen of the older school cease to be available.

## NEW PATENTS APPLIED FOR, 1915.

**(NOT YET PUBLISHED).**

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

743. "Electrical switches." MIDLAND ELECTRIC MANUFACTURING CO., LTD., & W. L. BARBER. January 18th.

757. "Wire joiner for the purpose of connecting or joining telegraph or other wires." J. PARKER. January 18th.

760. "Wire and cable cutter." J. PARKER. January 18th.

764. "Electric switchboards." C. TURNBULL, JUN. January 18th.

767. "Door lock and contact for electric elevators." H. P. MCCOLL. January 18th. (Convention date, January 23rd, 1914, Australia.) (Complete.)

821. "Circuit arrangements for telephone systems." W. H. GRINSTED. January 18th. (Complete.)

823. "Automatic apparatus for electrically-illuminated signs and the like." E. SAVOYE. January 18th. (Convention date, January 20th, 1914, France.) (Complete.)

831. "Stray-wave protective devices for electric circuits." SIEMENS-SCHUCKERTWERKE G.M.B.H. January 19th. (Addition to 17,532/13. Convention date, January 20th, 1914, Germany.) (Complete.)

850. "Universal coupling for motors, whether driven by oil, electricity, steam, or gas." S. WILLOUGHBY. January 19th.

863. "Sparking-plugs for internal combustion engines and the like." W. F. GRAFTON & W. D. CAIRNEY. January 19th.

869. "Manual and semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., & W. AITKEN. January 19th.

882. "Dynamo-electric machines and installations." SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. January 19th. (Convention date, February 7th, 1914, Belgium.) (Complete.)

884. "Arc lamps." J. W. ALLISON & T. HADAWAY. January 19th. (Complete.) (Convention date, December 16th, 1914, United States.)

891. "Electro-magnetic levitating apparatus." E. BACHELET. January 19th.

893. "Electrical switches." SIR A. T. DAWSON & J. HORNE. January 19th.

895. "Electrical receiving apparatus." SIR A. T. DAWSON & J. HORNE. January 19th.

900. "Distribution fuse boards for electrical circuits." MIDLAND ELECTRIC MANUFACTURING CO., LTD., & W. L. BARBER. January 20th.

901. "Electrical switches." MIDLAND ELECTRIC MANUFACTURING CO., LTD., & W. L. BARBER. January 20th.

913. "Electro-magnetic guns." F. REARDON. January 20th.

924. "Moving coil voltmeters, ammeters, and the like for direct currents." A. HONIG. January 20th.

937. "Electric light prepayment apparatus." H. S. J. BOOTH & W. MILLER. January 20th.

939. "Circuit arrangements for telephone systems." O. IMRAY (Siemens & Halske Akt. Ges., Germany). January 20th. (Complete.)

942. "Dry battery." H. E. HUGHES. January 20th.

945. "Electric switch and fuse service boxes." H. F. REASON. January 20th.

982. "Electrical apparatus for effecting the chemical combination of gases." C. C. MEIGS. January 21st. (Convention date, January 23rd, 1914, United States.) (Complete.)

986. "Means for selecting one or more punches (in a keyboard perforator) with one punch-selector." S. J. ANDERSON. January 21st.

1,006. "Register circuits for telephone systems." O. IMRAY (Siemens & Halske Akt. Ges., Germany). January 21st. (Complete.)

1,007. "Means for obtaining periodically-interrupted currents of electricity." W. H. GRINSTED. January 21st. (Complete.)

1,016. "Electric signalling, especially applicable to collieries." S. G. LEACH & E. G. BROWN. January 21st.

1,076. "Heating-unit or resistance element for electric heating apparatus." A. SLATTER & G. WILDE. January 22nd.

1,085. "Controlling and indicating electric motors from a distance and the application thereof to weighing machines." STOTHERT & PITT, LTD., & E. S. FRANKLIN. January 22nd. (Complete.)

1,087. "Telephone systems." J. E. COOLEY. January 22nd. (Convention date, January 23rd, 1914, United States.) (Complete.)

1,088. "Methods of exhausting incandescent lamps or similar envelopes." BRITISH THOMSON-HOUSTON CO., LTD. January 22nd. (General Electric Co., United States.)

1,090. "Electrical terminals." STERLING TELEPHONE & ELECTRIC CO., LTD., & T. D. WARD-MILLER. January 22nd.

1,091. "Detectors." STERLING TELEPHONE & ELECTRIC CO., LTD., & T. D. WARD-MILLER. January 22nd.

1,093. "Regulation or control of electric currents." J. STONE & CO., LTD., & A. H. DARKER. January 22nd.

1,119. "Electrical alarm apparatus for mines and like places." J. F. O'DONNELL. January 23rd. (G. D. Hodges & D. Smith, Transvaal.)

1,124. "Electro-magnetic apparatus." BRITISH THOMSON-HOUSTON CO., LTD., & W. L. WISE. January 23rd.

1,126. "Electrically-driven starting mechanism for internal-combustion engines." H. LUCAS & W. C. TURNER. January 23rd.

1,139. "Supply of electrical power." W. A. PRICE. January 23rd.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford, price, post free, 9d. (in stamps).

### 1913.

15,879. HEATING BY ELECTRICITY. P. R. Wilde. July 9th.

21,732. MICROPHONES, TRANSMITTERS, DETECTORS AND THE LIKE. J. K. Pickford. September 26th.

22,359. ELECTRICAL BAKING APPARATUS. W. P. Perry. October 4th.

22,537. WIRELESS TELEGRAPH TRANSMITTER. J. G. Balsillie. October 6th.

22,575. FUSES OR CUT-OUTS FOR ELECTRIC CIRCUITS. V. Hope. October 7th. (Cognate application, 6,122/14.)

24,274. ELECTRIC FITTINGS SPECIALLY APPLICABLE TO FUSES. V. Hope. October 27th.

27,114. SPARK PLUGS. E. W. Cole. November 25th.

27,617. ELECTRO-MAGNETIC POWER TRANSMISSION APPARATUS FOR AUTOMOBILES AND OTHER PURPOSES. December 1st. (August 12th, 1913.)

28,834. FLASHLIGHT SIGNALLING SYSTEMS. W. H. Shephard & A. E. McKechnie. December 13th.

### 1914.

73. MEANS FOR APPLYING ELECTRIC POWER TO ASSIST OR SUPPLEMENT HAND POWER FOR STEERING OR OTHER PURPOSES. W. H. Scott. January 1st.

165. CLOCKWORK-CONTROLLED MECHANISM FOR OPERATING GAS VALVES, ELECTRIC SWITCHES AND THE LIKE. E. H. Horstmann, G. O. H. Horstmann, A. Horstmann, S. A. Horstmann & W. T. Edgar. January 3rd.

194. ENHANCING THE PERMEABILITY OF MAGNETIC MATERIAL. Prof. E. Wilson. January 3rd. (Cognate applications, 2,197/14, 5,012/14, and 5,844/14.)

344. DRIVING PROPELLING OR FEED MECHANISM FOR RECORD STRIPS AND THE LIKE. A. J. Jung. January 6th.

345. SPEED-RECORDING, OPERATION-RECORDING, OR SIMILAR INSTRUMENTS OR APPARATUS. A. J. Jung. January 6th.

518. MULTI-SAFETY-FUSEPLUG FOR ELECTRIC CIRCUITS. C. F. Christensen & W. Wettergreen. January 8th.

561. METHOD OF AND MEANS FOR DETERMINING AND ADJUSTING THE SPEED OF ROTATION OF IMPULSES TRANSMITTING-DEVICES FOR AUTOMATIC TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). January 8th.

722. MOUNTING AND DRIVING OF THE MAGNETO IN INTERNAL-COMBUSTION ENGINES. Butterfields, Ltd., & W. H. Butterfield. January 10th.

749. SUPPORTS FOR ELECTRIC TROLLEY WIRES. K. Von Kando. January 10th.

967. DYNAMO-ELECTRIC GENERATORS. H. Wade (C. T. Mason.) January 13th.

1,309. LIFE-GUARDS FOR TRAMCARS AND THE LIKE. W. Philipson, T. W. H. Philipson, & P. C. Philipson. January 17th.

1,363. COIN-ACTUATED MECHANISM. R. C. Griesbach & Venner Time Switches, Ltd. January 17th.

1,578. SIGNALLING-DEVICES FOR RAILROADS. F. A. C. Leigh & L. W. Swainson. January 20th.

1,595. SIGNALLING APPARATUS, MORE ESPECIALLY FOR USE IN COLLIERIES. J. Davis & Son (Derby), Ltd., & W. H. Davis. January 21st.

1,975. CONTROLLING SYSTEMS FOR ELECTRIC MOTORS. G. R. Radley. January 24th. (January 25th, 1913.)

2,388. SWITCHES FOR USE IN CONNECTION WITH ELECTRIC LAMP SOCKETS AND THE LIKE. E. C. R. Marks (Benjamin Electric Manufacturing Co.). January 29th.

3,858. INDUCTION MOTORS. W. Hartnell & B. D. Rayner. February 14th.

4,133. PROTECTIVE DEVICES FOR ELECTRIC DISTRIBUTION SYSTEMS. British Thomson-Houston Co. (General Electric Co.). February 17th.

5,196. METHODS AND APPARATUS FOR SHAPING FILAMENTS FOR ELECTRIC INCANDESCENT LAMPS. J. Findlay. February 28th.

5,380. ELECTRIC RE-LIGHTING APPARATUS FOR SAFETY LAMPS AS USED IN MINES. J. J. Pugh. March 3rd.

8,499. ELECTRIC CUT-OUTS. British Thomson-Houston Co. (General Electric Co.). April 3rd.

9,594. AUTOMATIC FIRE OR TEMPERATURE ALARMS. A. G. Pemberton. April 18th.

10,505. REGULATING DEVICE FOR DYNAMO-ELECTRIC MACHINES. W. S. Jeal. April 28th.

11,120. ANTENNAE FOR WIRELESS TELEGRAPHY AND TELEPHONY. N. J. Jeffries. May 5th.